

Hiawatha National Forest
Field Guide
For
Common Stand Exam (CSE)

April, 2009

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Section 1: General Information

Field Data Collection Procedures

Field data collection procedures are based upon Common Stand Exam (CSE) protocols that have been modified for the Hiawatha National Forest. This handbook addresses primarily those data elements that are currently being collected for CSE on the Hiawatha NF. (In general, "1000"; that is, "Quick Plot", Tree Data only.) If/when the HNF begins collecting data at a more intensive level, this field guide may need to be updated. A complete listing of CSE data fields are available from the FS VEG web page:

<http://fsweb.nris.fs.fed.us/products/FSVeg/documentation/index.shtml>

Field Data Forms

It is desired that field data be collected electronically. However, blank data collection forms for collecting data on paper are located in Section 6, "Data Collection Forms". The standard FSVEG data collection forms have been edited to reflect the modified HNF inventory procedures. These forms may be photocopied and used to collect data if data is not being collected electronically. (This requires transfer to electronic format in order to be uploaded into FSVEG, increasing chance of human error.) Contract data must be submitted in electronic format. Any desired modifications to these forms should be brought to the attention of the district silviculturist and they will bring the desired modification to the HNF inventory team for possible inclusion.

Stand Examination Types

There are three different Stand examination types:

Quick Plot – A quick plot exam may group trees by species, diameter, heights and/or damage classes on both large and small plots. These exams collect stand structural data in an efficient manner. Diameters of live trees are recorded by 2 inch DBH class and standing dead tree heights may be ocularly estimated. Limited tree defect information is collected, growth data is not collected, and small tree measurements may be recorded in groups. By limiting the information gathered and reducing measurement accuracy standards, significant cost savings are realized. The main uses of a quick plot are:

- cover and stand structure estimates by vegetative layer,
- exams in single species or single storied stands,
- timber stand improvement inspections,
- post treatment examinations,
- general surveys such as mistletoe surveys

Unless specifically stated otherwise, stand exam information will collected using this method.

Extensive - An extensive exam collects accurate tree measurements to tolerance standards tighter than a quick plot, but not as tight as an intensive exam. Trees on the large plot are recorded individually, but trees on the small plot may be recorded in groups. Diameters of live trees are measured to the nearest inch. Heights are measured to the nearest 5 feet. Tree defect information is collected. The main uses of an extensive exam are:

- minimum data required to execute growth and yield models,
- exams in multistoried stands,
- silvicultural prescriptions.

Intensive – An intensive exam collects accurate tree measurements to tight tolerance standards. It provides a comprehensive inventory for unique stands. Trees on the large plot are recorded individually, but trees on the small plot may be recorded in groups. Diameters

of live trees are measured to the nearest 1/10th of an inch. Heights are measured to the nearest foot. Detailed tree defects are collected. The main uses of an intensive exam are:

- stand volume, defect, and mortality,
- exams in complex stands in terms of species and size,
- supplemental cruise plots to reduce costs for timber sale preparation,
- tree growth information for use in tree models, and growth and yield studies, and
- silvicultural prescriptions.

Required Fields

The following fields are required regardless of the examination level.

Setting: Project Name
Region
Proclaimed Forest Number
District
Location
Stand Number
Date
Exam Level

Design: Selection Method
Expansion Factor

Point: Point Number

Surface: Point Number

The following fields are required depending on the examination level. Additional fields can be collected (and may be required for certain projects or contracts) with any examination level as long as the required fields are collected.

Tree Form

Field	Quick Plot	Extensive Plot	Intensive Plot
Plot Number	X	X	X
Tag Number		X	X
Tree Status	X	X	X
Site/GST Tree			X
Tree Species	X	X	X
Tree Count	X	X	X
DBH/DRC	X	X	X
Height	Trees < 4.5 feet tall and S.I. Trees	Trees < 4.5 feet tall and S.I. Trees	Trees < 4.5 feet tall and S.I. Trees
Age	S.I. Trees	S.I. Trees	S.I. Trees
Crown Ratio			X
Crown Class		X	X
Damage Category		X	X
Damage Agent			X
Damage Severity		X	X

Requirements for Vegetation Composition, Down Woody, and Ground Surface are not included at this time.

Accuracy standards for all items are listed in Section 7 within the inspection forms.

Section 2: Setting

Accuracy Standards are found in Section 7, within the inspection forms. The paper Setting Form is shown in Section 6, "Data Collection Forms".

In the FSveg database and the Common Stand Exam program, a "setting" is usually a "stand". Certain data fields uniquely identify each setting. The date field is used to uniquely identify the setting from multiple surveys from the same location, over time. Complete one Setting Form for each setting.

Project Name (25-character)

Multiple settings may use the same project name. A project name is a useful way to group settings. Example project names are "CSE stand exam", "CSE Bat exam", and "post harvest exam". *For Common Stand Exam contracts on the HNF, the default project name will be "CSE" (without quote marks), unless otherwise stated.*

Region (2-digit)

Record the proclaimed Region where the stand is located.

Code	Description
09	Region Nine - Eastern Region (default)

Proclaimed National Forest (2-digit)

Record the proclaimed National Forest where the setting is located. (default)

Code	Description
10	Hiawatha (default)

District (2-digit)

Record the Ranger District number where the setting is located. (default)

Code	Description
01	Rapid River
02	Manistique
03	Munising
04	Sault Saint Marie
05	St. Ignace

Location (compartment) (5-digit)

Use leading zeros to complete the compartment code. Leading zeros are required

Setting (stand) (4-digit)

Use leading zeros to complete the setting code. Record the setting (stand) number consistent with the current vegetative polygon map layer, unless creating a new setting.

Ownership (4-character)

Record the following ownership code:

Code	Description
USFS	US Forest Service (default)

State (2-character)

Record the State in which the setting is located. A setting cannot cross state boundaries.

Code	Description
MI	Michigan (default)

County (3-digit)

Record the County in which the setting is located.

Code	Description
003	Alger
033	Chippewa
041	Delta
097	Mackinac
103	Marquette
153	Schoolcraft

Administrative Forest (2-digit)

Record the administrating National Forest where the setting is located.

Code	Description
10	Hiawatha NF (default)

Administrative Region (2-digit)

Record the administrating National Forest where the setting is located.

Code	Description
09	Region Nine - Eastern Region (default)

Date (8-digit)

Record the calendar month, day, and year the stand examination was completed. The format is MMDDYYYY. (On PDR, current date will fill automatically. To select another date, use pop-up calendar to navigate to and select appropriate date.)

Code	Description
07071977	July 7, 1977
12272004	December 27, 2004

Examination Level (4-digit)

Record the examination level that identifies the scope and range of information being collected. Scope is the breath of information collected (type of form – “tree”, “veg”, “ground”, etc.), and range is the precision of information collected (examination level). The intensity implies a measurement standard, sample design, and sample selection criteria. The actual criteria used to sample the stand must be documented on the Sample Design Form. The range of data collected on each form is one of the following:

Code	Description
0xxx	This form was not used
1xxx	Quick Plot (default)
2xxx	Extensive examination
3xxx	Intensive examination

For example, a code of 1000 indicates the following:

Tree Form	Veg. Composition	Down Woody Mat'l.	Ground Surface Cover
Quick (1)	Not taken (0)	Not taken (0)	Not taken (0)

Down Woody & Ground Surface forms may only have values of zero (not taken) or 1 (taken).

Unless otherwise stated, HNF contract exam level will be “1000”.

Exam Purpose (2-character)

Record the purpose of the exam. These codes are locally defined. Most exams will use "SE". Other purposes may be used, as applicable (and directed by FS silviculturist).

Code	Description
SE	Stand Exam – Used to determine stand composition.
RE	Regeneration/Stocking – Used to determine stocking rates of stands or partial stands. If certifying stand, use "SE" code.
ID	Insect & Disease Exams – Used to verify types and severity of infestation as an aid in determining treatment needs.

Existing Vegetation Reference Code (5-digit)

Record the existing vegetation reference code.

Code	Description
FSHR9	Region 9 Forest Service Handbook (default)

Existing Vegetation (2-character)

Existing Vegetation (EV) refers to the Forest Type of the dominant commercial forest tree species currently present on the area evaluation plot or at the setting level. At plot level, record EV based on plot trees, as well as trees in the immediately surrounding area. At setting level, record EV based on the overall stand. EV codes & descriptions for the Hiawatha are listed in Appendix A.

Structure (2-digit)

Record the stand-level setting structure.

Code	Description
SS	Single story - A single even canopy characterizes the setting. The greatest number of trees is in a height class represented by the average height of the setting; there are substantially fewer trees in height classes above and below this mean.
TS	Two-storied - Two relatively even canopy levels can be recognized in the setting. Understory or overtopped trees are common. Neither canopy level is necessarily continuous or closed, but both canopy levels tend to be uniformly distributed across the setting (e.g., overstory with regenerated understory).
MS	Multi-storied - At least three height size classes are commonly represented in the setting. Generally, the canopy is broken and uneven although multiple canopy levels may be distinguishable. The various size classes tend to be uniformly distributed throughout the setting.
MO	Mosaic - At least two distinct height size classes are represented and these are not uniformly distributed, but are grouped in small repeating aggregations, or occur as stringers less than two chains wide, throughout the setting. Each size class aggregation is too small to be recognized and mapped as an individual setting.
UA	Unknown/un-assessable - A structure classification was attempted, but the stand did not fit into one of the pre-defined categories. Note in the remarks column the reason the stand could not be classified.

Slope (3-digit)

Record the slope, in percent.

Slope Position (2-character)

Record the position of the setting on the landscape. (Currently, local codes cannot be used in CSE, so do not collect this data. It may be added in the future.)

Code	Description	Former Code
FS	Flat Dry	5
VB	Flat wet	4
SU	Rolling or undulating	6
BS	Broken	7
SH	Dry Hillside	3
TS	Wet Hillside	2

Acres (up to 4-digit)

Record the total setting acres. Currently, the CSE program does not accept decimals; round up or down to the nearest acre.

Code	Description
3	3 acres
24	24 acres
100	100 acres

Examiner (maximum of 12-letters)

Record the individual(s) responsible for data collection. Use last name or last name and first initial. Example, for Tom Smith, use: Smith or Smith_T. When using a Portable Data recorder, do not use reserved characters such as +, /, -, or * in this field. This field can be set up to default to the recorder's name.

Precision Protocol (maximum of 5 letters)

This field is used to indicate level of precision of the exam. For HNF contracts, use "CSE_Q" in this field (default), unless otherwise specified.

User Code (Size-density) (1-digit)

At the setting level, record the size-density code only after all plots have been completed. The basal area tally of trees recorded in Tree Data should be used as a guide. Technique for size/density determination is different for stands below 5.0 inches DBH than for stands larger than 5.0 inches DBH. See the paragraphs following the codes for procedures. The following codes should be used:

Size-Density Codes & Description	
Code	Description
0	Nonstocked (less than 16% stocked)
1	Seedling-Sapling; Poor (16% - 39% stocked)
2	Seedling-Sapling; Medium (40% - 69% stocked)
3	Seedling-Sapling; Well (over 70% stocked)
4	Poletimber; Poor (16% - 39% stocked)
5	Poletimber; Medium (40% - 69% stocked)
6	Poletimber; Well (over 70% stocked)
7	Sawtimber; Poor (16% - 39% stocked)
8	Sawtimber; Medium (40% - 69% stocked)
9	Sawtimber; Well (over 70% stocked)

For stands that average less than 5.0 inches DBH, size-density is an estimate of stocking in seedling and sapling stands and is determined with a series of 1/750-acre plots (or other size, as specified). Here, a stocked versus non-stocked relationship is determined. For example, if

10 plots were taken and five were stocked, the stand would be 50% stocked or size density code = 2. Complete the size-density field at setting level after all plots have been completed.

For stands which average 5.0 inches DBH and larger, generally consider only live trees with DBH of 5.0 or greater, regardless of the total number of trees actually recorded in plots. The exception would be if there are trees less than 5.0 inches DBH that are of truly acceptable growing stock. Complete size-density field at setting level after all plots have been completed to reflect the examiner's overall opinion of the averages that have occurred throughout the stand.

Setting Remarks (242-character)

Record required items in this space, as well as remarks about specific observations on overall setting conditions; i.e., stand was recently cut, stand has good understory of balsam, etc. Remarks must be entered in ALL CAPITAL LETTERS, i.e. – UPPERCASE. Do not use special characters such as !, @, #, \$, %, ^, &, *, (,), /, \, etc. Dashes and underscores are allowed. Remarks need to be understandable, complete and incorporate the various codes in this section. Up to 242 characters are allowed. Before leaving a stand, make a final check to be sure all important remarks have been recorded.

Required items for the remarks field include: Timber Land Suitability Class, Year of Origin (even-aged stands), Stand Condition, Stand Rx (if stand is ready for treatment), Vegetation Type (for openings), and Regen (if applicable). Additional items to enter as applicable: Within-Stand Features, Species of Management Interest, and Stand Damage Category/Agent/Severity. Descriptions and codes for most of these items are given in the following table and in the paragraphs following.

Remarks Requirement	When to Use	Format
Timber Land Suitability Class	Mandatory (See appendix C)	TLSCnnn
Stand Year of Origin	Mandatory for even-aged stands (y = Year)	YORyyyy
Stand Condition	Mandatory (See below)	SCn
Stand Prescription	If stand is ready for treatment (See appendix D)	Annnn
Vegetation Type	For non-forested stands (See appendix B)	VTnn
Stand Features	As applicable (See appendix E)	Fnnn
Site Index tree	Record location of Site Index tree for timbered stands	SI IN PLOT 3.

Put important remarks earlier, less important remarks later. For TLSC100 and TLSC200 (water & openings), enter a description of the opening. If work is needed to enhance the opening or to keep it in an open state, describe.

If a silvicultural harvest or other activity is needed within the next 10 years, enter a short prescription; if more than one management option is possible, provide a short description of the options listing the most preferred option first. If access to stand is obstructed (slope, wetlands, substandard bridge, etc.) enter extent of problem. On the Westside, in stands harvested within the last 5 years, enter the percent of regeneration for the stand-as-a-whole, by species, in Setting Remarks and indicate whether or not the stand can be Certified as "Fully Restocked and Regenerated".

Remarks Example
TLSC500, YOR1929, SC6, A4151 - UPLAND WELL-STOCKED NH WITH GAPS AND SM REGENERATION. VERNAL POOL IN SW. F404, F440, F408. SI TREE IN PLOT 3. (If this were an opening, (EV codes 97, 98, or 99), also include veg type. For example: VT51.)

Timber Land Suitability Class - TLSC

Record TLSC from the previous compartment record or recommended changes to TLSC in Setting Remarks. For example, TLSC500, or CURRENTLY TLSC 820, CONSIDER CHANGING TO 500. TLSC codes & descriptions are in Appendix C.

Stand Condition – Record stand condition as “SCx” under Setting Remarks. *NOTE: These codes are changed from the 2006 HNF User Guide.

Stand Condition	
Code	Description
1	In Regeneration
2	Damaged pole timber
3	Damaged sawtimber
4	Forest pest infestation
5	Sparse pole timber
6	Sparse sawtimber
7	Low quality pole timber
8	Low quality sawtimber
9	Mature pole timber
10	Mature sawtimber
11	Immature pole timber
12	Immature sawtimber
13	Seedling and sapling
14	Adequately stocked seedlings and saplings
15	Inadequately stocked / nonstocked
16	Group selection management
17	Individual tree selection management
18	Two aged management

Stand Prescription

Prescription activities should be considered for every stand. If a stand will be ready for treatment within the next ten years, note in remarks, using the codes from Appendix D, Activity Codes & Descriptions. Enter the code in Setting Remarks as a 4-digit numeral, preceded by “A”, with no spaces between: “Annnn”.

NON-FOREST Vegetation Types - Areas with less than 16 percent stocking of trees (which are not in the process of regenerating following a final harvest cut) are classified as one of the non-forested vegetation types listed in Appendix B. No overstory plots are needed in non-forested vegetation types, except in the savannah and orchard types. In these two types, three overstory and six understory plots should be taken. Locate sample points at locations which are most representative of the stand. Record in Setting Remarks as VTnn.

WITHIN STAND FEATURES – A 3-digit code that enables the examiner to record unique and important features of the stand that are not recorded elsewhere. These features include the presence of sensitive wildlife species, vegetative and geological features, recreational facilities and use, cultural resource sites and utilities. All within stand features that are observed anywhere in the stand by the examiner should be coded and recorded. Additional explanations can also be noted in Setting Remarks or a compartment narrative (for contract CSE). Record 3-digit code preceded by “F”: “Fnnn”. Stand Feature Codes and Definitions are found in Appendix E.

Damage Category (maximum 2-digit)

Damage category/agent/severity should be recorded in setting remarks if damage is present throughout the stand or if damage is seen within the stand, but not picked up at the Plot or Tree level. Use codes available under "Tree Data" or in Appendix K. Record as "DCnn".

Example of codes and descriptions for Damage Category:

Code	Description
12	Defoliators

Damage Agent (maximum 3-digit)

Record the damage agent associated with the category, if known. Use codes available under "Tree Data" or in Appendix K. Record as "DAnn".

Example of codes and descriptions for Damage Agent:

Code	Description
41	Jack Pine Budworm

Damage Severity (maximum 5-digit)

Record the damage severity associated with category & agent. Use codes available under "Tree Data" or in Appendix K. Record as "DSn".

Example of codes and descriptions for Damage Severity:

Code	Description
4	Defoliation 26-75%, no topkill

In remarks, the previous example would be recorded as, "DC12_DA41_DS4".

Species of Management Interest (8-character)

Record plant species of management interest which occur in the setting, but do not occur on any of the plots. Species of management interest may include noxious weeds, threatened, endangered, or sensitive plants, or management indicator species. Note the approximate location of these species in the stand sketch notes. See Appendix G for a complete list of noxious weeds, threatened, endangered, and sensitive plants.

Note: This is only an indication of the presence of a species of management interest. To determine the extent of the occurrence, another exam should be conducted.

Examples:

Code	Description
CIAR4	<i>Cirsium arvense</i> - Canada Thistle - Noxious Weed
EUES	<i>Euphorbia esula</i> - Leafy Spurge - Noxious Weed
SUAQ	<i>Subularia aquatica</i> - Water Awlwort - Threatened

Sketch Map And Traverse Notes

Make a sketch of the setting showing the relative location of the plots. Record azimuth and distance for each transect. Include a north arrow and other notable features such as roads, trails, lakes, and creeks that will assist in relocating the plots. Label each feature. This map is not stored in the database. Sketch map may be done on printed GIS aerial photo or compartment map. Azimuth and distance should be recorded on paper setting form or in Plot Remarks after plot has been established.

Section 3: Sample Design

Accuracy Standards are found in Section 7, within the inspection forms.

Standard sample designs for common HNF inventories are provided below. Select the appropriate sample design for the survey being completed and enter it for each setting included in the inventory. If additional sample design options are needed, those options should be brought to the attention of the district silviculturist and they will bring the design to the HNF inventory team for development.

For HNF CSE contracts, sample designs will be provided within the contract.

Form Type

Record the form type for each set of sample design data. In Exams, there is a separate page for each form type. (Currently, only Tree Data is collected on the HNF.) Valid form types are:

Code	Description
TREE	Tree data form
VEGCOV	Vegetation cover form
SURCOV	Surface cover form
DNWDY	Down woody material form

Sample Selection Method Type (3-character)

Record the method by which trees, shrubs, grasses, or down woody material were selected. This field defines the type of each plot; fixed area plot (FRQ), variable radius plot (BAF), or a transect line (TRN).

Code	Description
BAF	Basal area factor for a variable radius plot.
FRQ	Frequency for fixed area plots or linear strip plots.
TRN	Fixed length transect line.

Sample Expansion Factor (maximum of 6 numbers; may include one decimal)

This field corresponds to the Sample Selection Method Type and converts tree or piece data to a per-unit-area basis. This field defines the size of each plot: the BAF used with the variable radius plot, the size of the fixed area plot, or the transect length.

Sample Selection Method Type	Code	Description
BAF	10	10 basal area factor
FRQ	4	The inverse of a 1/4 th acre plot or strip area
FRQ	1000	The inverse of a 1/1000th acre plot or strip area
TRN	27	The horizontal length of a transect line to the nearest foot.

Subpopulation Filter (8-character)

Record the filter to define the sample subpopulation. This field is used to specify that only standing live, only standing dead, only stumps, only down, or both standing live and standing dead vegetation will be sampled. This field is not used for the surface cover form type. Use the following codes:

Code	Description
LIVE	Live standing
DEAD	Dead standing
ALL	Both live and dead standing
STUMPS	Stumps
DOWN	Down logs

In rare cases, it is necessary to exclude specific species from the sample. In this case, enter the species code, a dash “-” with an “L” (standing live), a “D” (standing dead), or an “A” (standing live and standing dead) flag in the subpopulation filter field. Then, enter “SPP” in the subpopulation variable, and enter “999.9” in the subpopulation minimum value. Examples are:

Code	Description
POTR5-L	Exclude standing live aspen
PIBA-D	Exclude standing dead jack pine
LALA-A	Exclude both standing live and standing dead tamarack

In rare cases, it is necessary to exclude vegetation with specific damages from the sample. In this case, enter the damage category in the subpopulation filter field. Then, enter “DMG” in the subpopulation variable, and enter “999.9” in the subpopulation minimum value. Examples are:

Code	Description
21	Root/butt diseases
11	Bark beetles

To specify selection criteria for sampling a specific species:

- Enter the species and the live/dead/all condition in the Subpopulation Filter field,
- Enter the Subpop Variable, Subpop Minimum, and the Subpop Maximum for as many selection criteria records as are needed to adequately describe how the species is to be sampled.

Selection Criteria Number (maximum 2-digit)

Record a sequential number, starting with “1,” for each line of data within a sample selection method. Do not reuse a number between sample selection methods. Vegetation must meet **one** of the sequentially numbered criteria in order to be sampled on the plot type. If two or more lines have the **same number**, they are considered a “**set**,” and vegetation must meet **all** the criteria in the set in order to be sampled by that selection method. (This implies an “AND” relationship. Lines with different criteria numbers imply “OR” relationships.)

Example 1: On a fixed radius plot, sample all live trees which have **either** a diameter of 1.0 to 4.49 **or** have a height of .5 to 4.49. (Subpop. Variable, Minimum & Maximum are discussed later in this section.) This requires two **different** selection criteria numbers:

Form Type	Sample Selection Method	Sample Expansion Factor	Subpop. Filter	Selection Criteria Number	Subpop. Variable	Subpop. Minimum Value	Subpop. Maximum Value
TREE	BAF	20	ALL	1	DBH	1.0	4.9
				2	HGT	.5	4.49

Example 2: On a 27-foot transect, sample down woody pieces that are greater than 12 inches at the intersection diameter **and** are at least six feet long. This requires the **same** selection criteria number. This implies that **both** intersection diameter **and** piece length must be recorded in order for a piece of vegetation to meet these two criteria.

Form Type	Sample Selection Method	Sample Expansion Factor	Subpop. Filter	Selection Criteria Number	Subpop. Variable	Subpop. Minimum Value	Subpop. Maximum Value
DNWDY	TRN	27	DOWN	1	DIA	12.0	999.9
				1	LGT	6	999.9

Example 3: If both of the above selection parameters were placed on the same sample design form it would look like the following:

Form Type	Sample Selection Method	Sample Expansion Factor	Subpop. Filter	Selection Criteria Number	Subpop. Variable	Subpop. Minimum Value	Subpop. Maximum Value
TREE	BAF	20	ALL	1	DBH	1.0	4.9
				2	HGT	.5	4.49
DNWDY	TRN	27	DOWN	3	DIA	12.0	999.9
				3	LGT	6	999.9

The first two lines have **different** selection criteria numbers, hence a piece of vegetation would have to meet **either** one of the criteria to be sampled on the variable radius plot. The next two lines have the **same** selection criteria numbers, hence a piece of vegetation would have to meet **both** of the criteria to be sampled on the transect. This implies that **both** intersection diameter **and** piece length must be recorded in order for a piece of vegetation to meet these two criteria.

NOTE: When entering the sample design in the Exams program, the "Selection Criteria Number" field is called "Condition" and it allows only entries of "AND" or "OR". Use the selection criteria numbers, as described above, to work out the correct sample design before entering it into the Exams program. Then, when entering, use "OR" for designs like Example 1; use "AND" for designs like Example 2.

Subpopulation Variable (3-character)

Record the characteristic used to define the subpopulations sampled. This field defines which characteristic of the vegetation will be measured to see if it meets the sample criteria.

Code	Description
DBH	Diameter at Breast Height
DRC	Diameter at Root Collar
HGT	Height
CVR	Percent Vegetation Species Cover
SVC	Percent Surface Cover
LGT	Length
DIA	Diameter at Midpoint or Intersection
DMG	Tree Damage Category
SPP	Species

Subpopulation Minimum Value (maximum of 6 numbers; may include 2 decimals)

Record the minimum value for the subpopulation variables. Default is 0. For example, if the subpopulation variable is set at "DBH," this field defines the minimum DBH the vegetation must have in order to be sampled on the plot.

Subpopulation Maximum Value (4,1- digit)

Record the maximum value for the subpopulation variables. Default is 999.9. For example, if the subpopulation variable is set at "HT," this field defines the maximum height the vegetation must be in order to be sampled on the plot.

Sample Design Remarks (242-character)

Record information to explain the sample design used. Remarks are available for each line in the sample design form.

Example Sample Designs for Measuring Large Trees

Example 1: Sample all (standing live and standing dead) trees 5.0" + DBH with a 10 BAF.

Sample Selection Method	Sample Expansion Factor	Subpop. Filter	Selection Criteria Number	Subpop. Variable	Subpop. Minimum Value	Subpop. Maximum Value
BAF	10	ALL	1	DBH	5.0	999

Example 2: Sample live standing live trees 5.0" + DBH with a 20 BAF.

Sample Selection Method	Sample Expansion Factor	Subpop. Filter	Selection Criteria Number	Subpop. Variable	Subpop. Minimum Value	Subpop. Maximum Value
BAF	20	LIVE	1	DBH	5.0	999

Example 3: Sample standing dead trees 10.0" + DBH with a 20 BAF.

Sample Selection Method	Sample Expansion Factor	Subpop. Filter	Selection Criteria Number	Subpop. Variable	Subpop. Minimum Value	Subpop. Maximum Value
BAF	20	DEAD	1	DBH	10	999

Example Designs for Measuring Small Trees

Example 1: Sample standing live and standing dead trees .1-4.9" DBH, also sample live trees .5'- 4.49' in height on a 100th acre plot.

Sample Selection Method	Sample Expansion Factor	Subpop. Filter	Selection Criteria Number	Subpop. Variable	Subpop. Minimum Value	Subpop. Maximum Value
FRQ	100	ALL	1	DBH	.1	4.9
		LIVE	2	HGT	.5	4.49

Example 2: Sample standing live trees 1.0-4.9" DBH or 1.0-2.9" DRC on a 50th acre plot.

Sample Selection Method	Sample Expansion Factor	Subpop. Filter	Selection Criteria Number	Subpop. Variable	Subpop. Minimum Value	Subpop. Maximum Value
FRQ	50	LIVE	1	DBH	1.0	4.9
		LIVE	2	DRC	1.0	2.9

Example 3: Sample stumps 10.0"+ diameter at root collar on a 10th acre plot.

Sample Selection Method	Sample Expansion Factor	Subpop. Filter	Selection Criteria Number	Subpop. Variable	Subpop. Minimum Value	Subpop. Maximum Value
FRQ	10	STUMPS	1	DRC	10	999

Example 4: On a 300th acre plot; sample all (standing live and standing dead) trees 3.0-4.9" DBH EXCEPT aspen; sample standing live trees 0.1-2.9" DBH and .5-4.9' high EXCEPT aspen; and sample standing live aspen 1.0-4.9' in height.

Sample Selection Method	Sample Expansion Factor	Subpop. Filter	Selection Criteria Number	Subpop. Variable	Subpop. Minimum Value	Subpop. Maximum Value
FRQ	300	All	1	DBH	3	4.9
		POTR5-A	1	SPP	999	
		LIVE	2	DBH	0.1	2.9
		LIVE	2	HGT	.5	4.4
		POTR5-A	2	SPP	999	
		POTR5-L	3	HGT	1.0	4.9

Standard Sample Designs for use on the HNF:

Sample Design 1

Variable-radius overstory BAF plots with fixed-radius understory plots								
Form Type	Method	Expansion Factor	Condition	Subpop Filter	Variable	Min. Value	Max. Value	When Used
TREE	BAF	10		ALL	DBH	1.0	99.99	Overstory plots
TREE	FRQ	1000.0		LIVE	HGT	1.5	4.49	Understory plots
			OR	LIVE	DBH	.01	.99	Understory plots

*FRQ refers to Fixed Radius.

Sample Design 1 is intended for multi-aged, multi-storied stands. Sample Design 1 would typically be used in uneven-aged northern hardwood stands, mixed hardwood/conifer stands that have an established understory, two-aged stands, and the like. The examiner shall sample overstory trees for all plots on these types of stands using variable-radius 10-Basal Area Factor (BAF) to tally trees ≥ 1.0 " DBH.

Northern hardwood stands under the uneven-aged selection system, which have been cut within the last five years, shall also be evaluated by the examiner, re: whether or not regeneration has been adequately created in the understory. This shall be recorded in the Setting Remarks for the stand, as a whole, as to whether the regeneration is successful or not, whether the regeneration is healthy or not, and an estimate of the percent of regeneration by species.

Sample Design 2

Variable-radius overstory BAF plots without fixed-radius understory plots								
Form Type	Method	Expansion Factor	Condition	Subpop Filter	Variable	Min. Value	Max. Value	When Used
TREE	BAF	10		ALL	DBH	1.0	99.99	Overstory plots

Sample Design 2 is intended for even-aged stands such as CCC plantations and cedar swamps that have little or no understory. It may also be appropriate for younger, even-aged hardwood stands. In such stands, where regeneration is noted as patchy or sporadic, this may be reflected in Setting Remarks.

In very uniform, even-aged stands with minimal species variation and high average basal area, (pine plantations, cedar swamps, certain hardwood stands), examiner may opt to use a 20 BAF collection protocol, provided the examiner adjusts the Sample Design Form to reflect BAF 20. Data collected with 20 BAF must reflect the same end result as if it had been collected with 10 BAF. (i.e., Inspections may be done with 10 or 20 BAF to determine correct plot BA. It behooves the examiner to periodically check 20 BAF plots with a 10 BAF prism, to insure that the 20 BAF is "giving the same answer".)

Sample Design 3

Fixed-radius understory plots without overstory plots								
Form Type	Method	Expansion Factor	Condition	Subpop Filter	Variable	Min. Value	Max. Value	When Used
TREE	BAF	10		ALL	DBH	1.0	99.99	Overstory plots
TREE	FRQ	1000.0		LIVE	HGT	1.5	4.49	Understory plots
			OR	LIVE	DBH	.01	.99	Understory plots

Sample Design 3 is intended for openings, younger stands and regeneration surveys. For openings, there must be at least one *Plot Data* record, but the *Tree Data* table may have no entries. Though the design is the same as Sample Design 1, it is expected that collection of overstory data will be minimal (i.e., light residual and/or snags).

Regeneration survey plot sizes		
Sample size	Radius	Purpose
1/1000 acre	3.7-foot	To determine stocking levels in uneven-aged hardwood stands (in gaps), non-plantation conifer regeneration, and plantations with target stocking levels of 1000 trees per acre or greater.
1/750 acre	4.3-foot	To determine stocking levels in plantations with target stocking levels of 700-800 trees per acre. (Typically used for red pine plantations.)
1/500 acre	5.3 foot	To determine stocking levels in jack pine plantations. (Timber or KW goals)

Section 4: Plot Data

Accuracy Standards are found in Section 7, within the inspection forms. The paper Plot Form is shown in Section 6, "Data Collection Forms".

The Plot Data Form contains information about a sample plot or transect. This information is independent of the information collected in other sections. Record a separate set of plot data for each plot in the stand.

Plot Number (3-digit)

Record plot number for each sample plot within a setting. In Exams, plot numbers list automatically in the Plot Form, as lat/long, existing veg, and other items are entered for the plot. The number of plots listed in the Plot Form **MUST** equal the number of actual plots taken on the ground. (i.e., All plots listed in Exams must have field data entered into them – no "empty" plots.) For plots that have no trees (example, openings and regenerating clearcuts), plot data should indicate location (lat/long) and a "0" for the User Code (size density.)

Plot Latitude (8-character)

Record the plot latitude as measured by a Global Positioning System (GPS). Latitude consists of a 3-digit "degree", a 2-digit "minute", and a 3-digit "second". The second value is in the form XX.X.

Plot Longitude (8-character)

Record the plot longitude as measured by a Global Positioning System (GPS). Longitude consists of a 3-digit "degree", a 2-digit "minute", and a 3-digit "second". The second value is in the form XX.X.

GPS data collection shall be initiated as soon as possible at the plot center. The GPS will continue to operate while field personnel are collecting other site data. Every effort should be made to maximize GPS data without compromising the true plot center location. If something obstructs GPS data collection, the GPS unit may be moved to a place where data can be collected, within a 30 foot radius of plot center, and bearing and horizontal distance to plot center recorded. If GPS data cannot be collected due to satellite availability or other factors, the reason for the failure should be recorded along with documentation of attempts to relocate the GPS point as stated above. The exact time and date of the failure will also be recorded.

Note: The Exams program requires latitude and longitude. CSE contracts also require submission of a GPS file with UTM's in the following projection: NAD_1983_UTM_Zone_16N (Transverse Mercator).

Plot Slope (maximum of 3 numbers)

Record the angle of slope (as percent) across the plot. Slope is determined by sighting the clinometer along a line parallel to the average incline (or decline). This angle is measured along the shortest pathway down slope before the drainage direction changes. To measure Slope, Observer 1 should stand at the uphill edge and sight Observer 2, who stands at the downhill edge. Sight Observer 2 at the same height as the eye-level of Observer 1. Read the slope directly from the percent scale of the clinometer.

- If slope changes gradually across the plot, record an average slope.
- If slope changes across the plot but the slope is predominately of one direction, code predominate slope percentage rather than the average.
- If the slope falls directly between two side hills, code the average slope of the side hill(s).

- If the slope falls on a ravine bottom or on a narrow ridge top, but most of the area lies on one side hill, code the slope of the side hill.

Plot Existing Vegetation Composition Type (3-digits)

Record the dominant existing vegetation composition. At plot level, Existing Vegetation is a combination of what is found on the plot ("plot trees") as well as trees in the immediately surrounding area. (For example, if a plot in a red pine stand falls in a small inclusion that includes white pine and red pine, and there is more white pine than red pine, but the immediately surrounding area is all red pine, the plot EV could be coded 2 or 3, based on the examiner's educated opinion.) Existing vegetation reflects plant species currently present. See Appendix A for a complete list of existing vegetation composition codes. When entering in CSE, leading zeroes may be required to make a 3-digit number.

Plot Remarks (242-character)

Enter remarks relevant to the plot. Any within-stand features that fall within or near a plot should be recorded here; otherwise note in Setting Remarks.

User Code (3-digit)

Record the size-density code for each plot. Use codes and procedures are detailed in Section 2, "Setting".

Section 5: Tree Data

Accuracy Standards are found in Section 7, within the inspection forms. The paper Tree Data Form is shown in Section 6, "Data Collection Forms".

OVERSTORY PLOT DATA - The overstory plot consists of gathering species, size and quality information using a 10 Basal Area Factor plot. (In certain cases, a 20-factor prism may be used. Refer to "Standard Sample Designs for use on the HNF", discussion for "Sample Design 2", in the Section 3, Sample Design.) A wedge prism or Relaskop may be used to determine tally trees. Tally trees of all species which are larger than 1-inch DBH. All trees of the same species, diameter class and quality class can be recorded on the same line using the tree count field (except for the Site Tree, which must be measured to 1/10th of an inch dbh and recorded on it's own line).

UNDERSTORY DATA COLLECTION - A fixed- radius plot will be used to tally the number of seedlings of all woody species which are less than 1" DBH (see the Appendix H for species codes). The actual number of stems will be recorded by species code for each species counted.

In hardwood stands, count all seedlings taller than 1.5 feet but less than 1-inch DBH which have at least two normal sized leaves. In conifer stands, count all seedlings taller than .5 feet. (Sample design will determine this.)

The following table shows the fields required for Stand Exam on the HNF (subject to change). Currently, data is collected using "Quick Plot" exam level.

Field Name	Exam Level <i>Quick Plot</i>
Header Information	X
Plot Number	X
Tag #	X
Tree Status	X
Tree Class	X
Site Tree	One site tree per stand
Tree Species	X
Tree Count	X
DBH	Trees ≥ 4.5 feet tall.
Height*	One site index tree/stand; all dead trees; and trees < 4.5 ft. tall
Age	One site index tree/stand
Wildlife Use	As applicable
Tree Damage Category	As applicable
Tree Damage Agent	Required if Category is recorded.
Tree Damage Part	Required if Category is recorded.
Tree Damage Severity	Required if Category is recorded.
Treatment Option	Required if stand is ready for harvest.
Remarks	As applicable

*For dead trees (snags), give an ocular estimate of the tree height.
For Site Trees, height should be measured to the nearest foot.

Plot Number (3-digit)

Record the plot number for each line of tree data. Plot numbers shall be unique within a setting.

Tag ID Number (4-digit)

Record a number, unique within each plot, for each tree record. On each plot, start with '1' (at true North) and increment one number for each tree record. The tag ID, in conjunction with the plot number, uniquely identifies each line of tree data in a setting. (Each line may represent a single tree or a group of trees with the same characteristics – sp., dbh, etc.)

Tree Status (1-character)

Code	Description
L	Live - includes all standing trees that have at least one green point of growth. This includes deciduous trees that have lost their foliage for the season, and trees that have recently lost their leaves to defoliators, but will reflush.
D	Dead - standing trees without a green point of growth. Note: many of the tree fields are not used if the tree is a dead tree.
S	Stump - woody base of a tree left in the ground less than 4.5 feet tall. Note: many of the tree fields are not used for stumps.
X	Down (May use if Down Woody Material form is NOT used) - includes all trees (live or dead) that have their main stem lying on the ground, or are supported by branchwood. A tree is considered down if it is leaning more than 45 degrees from vertical, not self-supporting, and/or in contact with the ground.

Tree Species (8-character)

Record the species of every sampled tree and shrub in BAF variable-radius plot. Refer to Appendix X or drop down list in the PDR.

Tree Count (3-digit)

Record the number of sampled trees represented by each line of tree data. **Record growth sample trees and site trees individually.** Note: When determining "in" and "out" trees, measure from plot center to the FACE of the tree in question to determine limiting distance.

Record trees ≥ 1.0 " DBH individually for intensive and extensive examinations. Trees ≥ 1 " DBH may be recorded in groups for quick plot examinations. (Example, for quick plot, group overstory trees of the same status, species, and 2" DBH class.)

Deleted:

Trees with less than 1.0" DBH, of the same tree status and species (which are not a GST or Site tree) may be grouped by height classes (Quick Plot, only). One height grouping method is:

- <0.5 feet
- 0.5 – 1.5 feet
- 1.51 – 3.0 feet
- 3.01 - 4.49 feet
- 4.5 – 9.9 feet

The height grouping reflects age class distribution. Distinguishing characteristics other than tree status, species, and height may warrant further grouping or individual tree recording. Such characteristics include age, crown ratio, crown class, or tree damage. Select the median tree to sample tree characteristics, such as DBH, height, etc.

1) Tree Count Accuracy Standards (small fixed area plot):		
Height Range	Actual Trees On Plot	Accuracy Standard
All**	0	0 trees
0.2 – 1.5 foot	1 - 10	+/- 1 tree
0.2 – 1.5 foot	11 - 50	+/- 10%
0.2 – 1.5 foot	51+	+/- 25%
1.5 - 4.49 foot	1 - 10	+/- 1 tree
1.5 - 4.49 foot	11 - 20	+/- 10%
1.5 - 4.49 foot	21 +	+/- 25%

*When contracting exams, there is zero tolerance for recording a tree when none are actually present in any of the above size classes. The recording of a fixed plot tree when none are present will result in a single discrepancy. The recording of a variable plot tree when none are present will result in an unacceptable error. For more info on accuracy standards, refer to sample inspection forms.

DBH (3,1-digit) (maximum 3 digits, decimal may be included)

Record the Diameter at Breast Height (DBH) for each tree or group of trees. When measuring individual trees, measure them to the nearest 2 inches (quick plot), 1 inch (extensive plot), or tenth of an inch (intensive plot). Examples of coding for quick plot exams are listed below.

DBH Classes	CODE
1.00 > 2.9	2.0
3.00 > 4.9	4.0
5.00 > 6.9	6.0
7.00 > 8.9	8.0
9.00 > 10.9	10.0
Etc.	Etc.

***Exception: Site trees must be measured to 1/10th inch dbh.**

DBH is outside bark diameter at 4.5 feet above the forest floor on the uphill side of the tree. To determine breast height, the forest floor includes the duff layer that may be present, but does not include unincorporated woody debris that may rise above the ground line. If a dead tree (snag) is missing bark, measure the DBH without the bark and record that measurement.

Some trees have substantial bole irregularities at breast height such as branches, swellings, or depressions. In such cases, take the diameter measurement as close as possible to breast height, but above the deformity. If this is not possible, because of the vertical extent of the irregularity, then adjust the DBH measurement to better reflect the diameter of a regular bole. See Appendix L for examples on where to measure DBH.

Tally trees that fork below breast height as two separate trees. Record the DBH for each fork at 4.5 feet above the forest floor.

Height (3-digit)

Record tree height in feet from ground line on the up-hill side to the uppermost tip. If the top is broken, record the height to the break, and record the appropriate physical damage code. See Appendix M for details on measuring tree heights. Tree heights are required for the following trees when using the Quick Plot exam method:

- Site Trees
- Growth Sample Trees

- Trees less than 4.5 feet tall. Does not apply to DRC species.
- All trees with broken or missing tops
- Dead trees (snags)

Additional tree heights should be measured and recorded in the following cases: when two adjacent sample trees of similar height can be viewed from the same vantage point, and when the height/diameter relationship of a particular tree seems atypical with respect to other trees of the same species. Tree heights will be measured to the nearest foot.

Code	Description
1	0 - 1.4 feet tall
23	22.5 - 23.4 feet tall

For more information on measuring tree height, refer to Appendix M.

Tree Age (3-digit)

Record the tree age, in years. This is required for Growth Sample trees and Site Index trees. Age is determined from an increment boring made at DBH and is the annual ring count to the pith of the tree. (Record the number of rings counted to the pith; do not add an estimate of the number of years to grow to breast height.) See Appendix N for details on how to determine tree age from increment borings. If age cannot be determined due to extensive heartrot, select another tree. Veneer of any species will not be bored to determine age. For more information on Site Trees, see that topic, later in this section.

Wildlife Use (2-character)

Record stem characteristics that may indicate the presence of wildlife.

Code	Description
NO	No wildlife characteristics observed
SC	Small cavities less than 3 inches in diameter
LC	Large cavities greater than 3 inches in diameter
LB	Loose Bark
FH	Foraging Holes/Flaked Bark: Antler Rubs, Porcupine feeding
NE	Nest in tree and not in cavity

Snag Decay (1-digit)

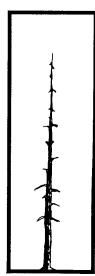
(**Not required for contract purposes.**) Record the condition of standing dead (snag) or down dead trees (log). The pictures and descriptions below are adapted from "Wildlife Habitats in Managed Forests of the Blue Mountains of Oregon and Washington," by Jack Ward Thomas, Agriculture Handbook No. 553, USDA Forest Service, September 1979. Note: If the Down Woody Material form is used, DO NOT record down trees on the tree form.

Snag Decay

Code	Bark	Heartwood Decay	Sapwood Decay	Limbs	Top Breakage	Bole Form	Time Since Death
1	Tight, intact	Minor	None to incipient	Mostly Present	May be present	Intact	1-5 years
2	50% loose or missing	None to advanced	None to incipient	Small limbs missing	May be present	Intact	>5 years
3	75% missing	Incipient to advanced	None to 25%	Few remain	Approx. 1/3	Mostly intact	>5 years
4	75% missing	Incipient to advanced	25%+	Few remain	Approx. 1/3 to 1/2	Losing form, soft	>5 years
5	75%+ missing	Advanced to crumbly	50%+ advanced	Absent	Approx. 1/2+	Form mostly lost	>5 years



Class 1
Dead / recent



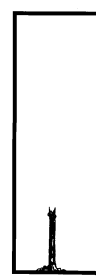
Class 2



Class 3



Class 4



Class 5

Tree Damage Category (2-digit)

See Appendix K for a complete listing of Tree Damage Categories, Agents, Tree Parts, and Severity codes.

Tree Damage Agent (3-digit)

See Appendix K for a complete listing of Tree Damage Categories, Agents, Tree Parts, and Severity codes.

Tree Damage Part (2-character)

See Appendix K for a complete listing of Tree Damage Categories, Agents, Tree Parts, and Severity codes.

Tree Damage Severity (5-digit)

Record the tree damage code for both live and dead trees, based on physical evidence. If category is recorded, severity is required.

Multiple damage codes may be recorded for each tree. To record multiple damage codes, enter the Point number, Tag ID, and damage code on the next line. Repeat for additional tree damages. See Appendix K for a complete listing of Tree Damage Categories, Agents, Tree Parts, and Severity codes.

Site Trees

Up to 3 Site Trees may be recorded within a stand using the extensive or intensive plot exam method. (For quick plot method, one site tree per stand must be recorded.) For all levels of exam, the site trees must be recorded individually, on their own line.

A site tree is a tree for which age and height are measured to determine site index and yield capacity for a tree. Site trees have never experienced any overstory competition or damage that would have reduced height growth during any period of their life. Freedom from height growth suppression is the single most important selection criteria for site trees. Site trees must be of a species for which site index relationships have been studied. Select a site index tree of the proper species for the Forest Type (See table under "Site Species" in this section.) that is a dominant or codominant tree within the stand. Veneer of any species will not be bored to determine age. If a veneer tree is the best site tree, it can be used to determine height and diameter but the age will be obtained from a neighboring non-veneer tree.

Site Tree Selection Criteria

1. Freedom from height growth suppression
 - Choose dominants or co-dominants depending on the specific site index curves used.
 - No damage which could influence height growth
 - No pronounced period of radial growth suppression
 - No Veneer will be bored to determine age
 - No evidence of top damage, past or present.
2. Select trees from a locally defined species list. (See species list, below.) Species preference is based on the quality of the associated site index-yield study.
3. Similar age class, preferably middle-aged, avoiding old growth and young age classes. Typically > 50 years and < 120 years.
4. Select at least one site tree from the sample trees tallied for each sample plot when the sample trees meet site tree criteria. (Quick plot requires just one site tree per stand.)

If a sample tree does not meet site tree criteria, select the nearest suitable site tree to the sample plot. Use code "S" to designate site trees located on the plot. Use code "F" to designate off-plot site trees. If there are not any on-plot or off-plot trees that meet site tree criteria, do not select a site tree for the plot.

Code	Description
S	On plot site tree
F	Off plot site tree

Measure DBH, age, and height on all site trees. Site trees must be measured (DBH) to 1/10th of an inch for all sample methods (extensive, intensive, quick). Measure total tree height to the nearest foot. Age is determined from an increment boring made at DBH and is the annual ring count to the pith of the tree. For more information on these measurements, refer to them specifically, earlier in this section.

Site Species - The following table should be used to determine which tree species may be used to determine site index in different forest types. To accurately reflect present stand productivity, select a site tree species which is a major component in the stand.

Code	Appropriate Species for Site Index Tree	Existing Vegetation Code (Forest Type)
ABBA	Balsam Fir	11, 13, 16, 18, 95
ACRU	Red maple	71, 72, 76, 79, 81, 82, 83, 84, 89
ACSA3	Sugar maple	59, 81, 82, 85, 87, 89
BEAL2	Yellow birch	5, 59, 81, 87, 89
BEPA	Paper birch	11, 19, 89, 91, 92
FAGR	Beech	81, 86, 87, 89
FRAM2	White ash	41, 55, 83, 89
FRNI	Black ash	71, 79
FRPE	Green Ash	79
LALA	Tamarack	15, 17, 18
PIAB	Norway spruce	7, 16
PIBA2	Jack pine	1, 2, 3, 48, 49
PIGL	White spruce	16, 17, 95
PIMA	Black spruce	12, 17, 18, 19
PIRE	Red pine	1, 2, 3, 49
PIST	Eastern white pine	2, 3, 4, 5, 41
PISY	Scotch pine	6
POBA2	Balsam poplar	91, 94, 95
POGR4	Bigtooth aspen	11, 19, 93
POTR5	Quaking aspen	11, 19, 91, 95
PRSE2	Black cherry	55, 83, 89
QUPA2	Northern pin oak	48, 49, 53, 59
QURU	Northern red oak	41, 48, 49, 55, 56, 59
THOC	Northern white cedar	14, 18, 19
TIAM	American Basswood	55, 76, 81, 84, 89
TSCA	Eastern Hemlock	5
ULAM	American elm	59, 71, 75, 79, 89

Treatment Option - Cut/Residual – In stands that are silviculturally ready for treatment, trees must be given a “cut” or “residual” code, as described in the following table. Follow the silvicultural system under which the stand should be managed. For example, in a mature stand of jack pine which is ready for clearcutting, all trees should be coded “9” for “cut” except for wildlife trees and snags which should be coded “1” for “reserve”. In an over-stocked hardwood stand that is ready for selection harvest, residual trees (crop trees, growing stock, wildlife trees, snags, etc.) should be coded “1”, while high-risk, defective, etc. should be marked “9” for “cut”.

Code	Treatment Option
1	Residual
9	Cut, commercial harvest

Section 6: Data Collection Forms (Paper)**Setting Form****PROJECT NAME:** _____ (25 characters total)

Proc. Region*	Proc. Forest*	District*	Location* (compartment)	Stand # *	Owner	State	County	Admin. Region	Admin. Forest	Date*
XX	XX	XX	XXXXX	XXXX	XXXX	XX	XXX	XX	XX	MM/DD/YYYY
09	10				USFS	MI		10	09	/ /
Exam Level*	Exam Purpose	Existing Veg. Code	Structure	Avg. Slope %	Acre	Examiner	Precision Protocol	Size-density code (User Field)		
XXXX	XX	FSHXXX	XX	XX	XXX	XXXXXXXXXXXX	XXX_X	(1 or 9)		
1000	SE	FSH					CSE_Q			

Remarks (242 characters)	(Include: TLSC, YOr, SC, WSF, SpMgtInt, Damage Cat/Agent/Severity, Regen, other)
-----------------------------	--

Sketch Map

NORTH ↑

TRAVERSE NOTES				
From	To	Azimuth	Distance	Correction
Reference Point	Plot 1			
Plot 1	Plot 2			
Plot 2	Plot 3			
Plot 3	Plot 4			
Plot 4	Plot 5			
Plot 5	Plot 6			
Plot 6	Plot 7			
Plot 7	Plot 8			
Plot 8	Plot 9			

Reference Point Info: _____

Other Info: _____

Region: 09 Proc. Forest: 10 District: _____ Location: _____ Stand Number: _____ Page ____ of ____[illegible]

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Section 7: Inspection Forms and Accuracy Standards

For CSE contracts – Refer to BOA Section G.

Calculation. Scores for each form will be calculated using the associated Inspection Form. Form Scores are determined by entering the total number of errors, corresponding to each field, found during the inspections of the inspection block and recorded in **Column B**, “Total Number of Errors”. **Column C**, “Point Deduction”, is calculated by multiplying **Column B** by **Column A**, “Point Value”. The Point Deductions are then totaled in **Field D**, “Total Deductions”. **Field F**, “Total Form Score” is calculated by dividing **Field D** by **Field E**, the total number of units (i.e., stands, plots or trees) that were actually inspected for that Form.

Point Deduction (Column C) = Total Number of Errors (Column B) x Point Value (Column A)

Total Form Score (Field F) = Total Deductions (Field D) ÷ the total number of inspected units (Field E)

G.3.1.2. The Total Score is calculated by summing all the Form Scores; see Total Form Score Calculation on the cover of the CSE Inspection Form. Errors in any field that has a Point Value of "unacceptable" will fail and the entire inspection block shall be returned to Contractor for rework.

Form Score.

- All Form Scores < 5.00 and Total Score < 10.00 = acceptable, 100% payment.
- Any Form Score ≥ 5.00 = unacceptable, all forms from entire inspection block, shall be returned for rework. No payment.

Total Score.

- Total Score ≥ 10.00 → ≤ 14.50 = acceptable/unacceptable, Contractor's discretion, implement reduced payment schedule at Contractor's request or rework entire inspection block.
- Total Score > 14.50 = unacceptable, all work from entire inspection block, shall be returned for rework. No payment.

The following reduced payment schedule shall be implemented at the Contractor's request if the Contractor's Total Score is ≥ 10.00% and ≤ 14.50%.

- ≥ 10.00 → ≤ 11.50% = 90% payment
- ≥ 11.51 → ≤ 13.00% = 80% payment
- ≥ 13.01 → ≤ 14.50% = 70% payment

An inspection block is considered complete when all work has been assessed for quality assurance and accepted for payment.

A letter of satisfactory completion of work will be issued and kept on file for work orders for which all form scores are < 5 and all total scores are < 10.

All inspection forms in the Field Guide are samples.
For CSE contracts, refer to applicable BOA.

COMMON STAND EXAM SUMMARY INSPECTION FORM																											
INSPECTION BLOCK NUMBER:		FOREST / UNIT: Hiawatha/																									
DATE RECEIVED:	DATE INSPECTION:	INSPECTORS:																									
NUMBER OF STANDS:	NUMBER OF STANDS INSPECTED:	L.S. TREE RECORDS INSPECTED:																									
NUMBER OF PLOTS:	NUMBER OF PLOTS INSPECTED:	S.S. TREE RECORDS INSPECTED:																									
OFFICE INSPECTION <ul style="list-style-type: none"> ● ALL REQUIRED MATERIALS RETURNED IN GOOD CONDITION. ● CORRECT NUMBER OF PLOTS COMPLETED IN EACH STAND. ● ALL REQUIRED FORMS AND FIELDS COMPLETED AND LEGIBLE. ● MINIMUM NUMBER OF SITE/GROWTH TREES COLLECTED FOR EACH SITE. ● ALL STANDS MEET MINIMUM TREE PER PLOT AVERAGES. ● ELECTRONIC DATA COMPLETE AND ACCEPTABLE. ● ALL STANDS HAVE PLOT DISTRIBUTION THAT SAMPLES ENTIRE STAND. 		DWM RECORDS INSPECTED: <table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th style="width: 33%;">ACCEPTABLE</th> <th style="width: 33%;">UNACCEPTABLE</th> <th style="width: 33%;">N/A</th> </tr> </thead> <tbody> <tr><td> </td><td> </td><td> </td></tr> <tr><td> </td><td> </td><td> </td></tr> <tr><td> </td><td> </td><td> </td></tr> <tr><td> </td><td> </td><td> </td></tr> <tr><td> </td><td> </td><td> </td></tr> <tr><td> </td><td> </td><td> </td></tr> <tr><td> </td><td> </td><td> </td></tr> </tbody> </table>		ACCEPTABLE	UNACCEPTABLE	N/A																					
ACCEPTABLE	UNACCEPTABLE	N/A																									
FIELD INSPECTION <ul style="list-style-type: none"> ● ALL INFORMATION ON SAMPLE DESIGN FORMS COMPLETE AND ACCURATE. ● ALL STANDS AND PLOTS HAVE CORRECT STAND ID (LOCATION, STAND #). ● ALL REFERENCE POINTS AND PLOT CENTERS RELOCATABLE. ● ALL PLOT LOCATIONS CORRECT AND UNBIASED. ● ALL PLOTS IDENTIFIED TREES $\geq 5.0"$ DBH CORRECTLY. ● ALL TREES $\geq 5.0"$ DBH HAVE SPECIES IDENTIFIED CORRECTLY. ● TREE STATUS FOR ALL TREES HAS BEEN IDENTIFIED CORRECTLY. 		<table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th style="width: 33%;">ACCEPTABLE</th> <th style="width: 33%;">UNACCEPTABLE</th> <th style="width: 33%;">N/A</th> </tr> </thead> <tbody> <tr><td> </td><td> </td><td> </td></tr> <tr><td> </td><td> </td><td> </td></tr> <tr><td> </td><td> </td><td> </td></tr> <tr><td> </td><td> </td><td> </td></tr> <tr><td> </td><td> </td><td> </td></tr> <tr><td> </td><td> </td><td> </td></tr> <tr><td> </td><td> </td><td> </td></tr> </tbody> </table>		ACCEPTABLE	UNACCEPTABLE	N/A																					
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OFFICE AND FIELD INSPECTION -- ANY UNACCEPTABLE ITEM FAILS INSPECTION BLOCK.																											
INSPECTION BLOCK TOTAL FORM SCORE CALCULATION <table style="width: 100%;"> <tr> <td style="width: 35%;">All form scores < 5.00% and Total Score < 10.00%</td> <td style="width: 35%;">= Pass (full payment).</td> <td style="width: 10%; text-align: center;"><div style="border: 1px solid black; width: 20px; height: 20px; display: inline-block;"></div></td> <td style="width: 20%;">PASS</td> </tr> <tr> <td>Any Form $\geq 5.00\%$</td> <td>= Rework forms that fail for entire inspection block.</td> <td></td> <td></td> </tr> <tr> <td>Total Score $\geq 10.00\%$ to $\leq 14.50\%$</td> <td>= Rework entire inspection block or implement reduced Payment schedule.</td> <td style="text-align: center;"><div style="border: 1px solid black; width: 20px; height: 20px; display: inline-block;"></div></td> <td>FAIL</td> </tr> <tr> <td>Total Score > 14.50%</td> <td>= Rework entire inspection block (no payment).</td> <td></td> <td></td> </tr> </table> Errors in any field that has a Point Value of "unacceptable" will fail the inspection block.				All form scores < 5.00% and Total Score < 10.00%	= Pass (full payment).	<div style="border: 1px solid black; width: 20px; height: 20px; display: inline-block;"></div>	PASS	Any Form $\geq 5.00\%$	= Rework forms that fail for entire inspection block.			Total Score $\geq 10.00\%$ to $\leq 14.50\%$	= Rework entire inspection block or implement reduced Payment schedule.	<div style="border: 1px solid black; width: 20px; height: 20px; display: inline-block;"></div>	FAIL	Total Score > 14.50%	= Rework entire inspection block (no payment).										
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INSPECTION CREW SIGNATURES: <div style="display: flex; justify-content: space-between; margin-top: 20px;"> <div style="width: 45%; border-bottom: 1px solid black;"></div> <div style="width: 50%; border-bottom: 1px solid black; text-align: center;">DATE</div> </div> <div style="display: flex; justify-content: space-between; margin-top: 20px;"> <div style="width: 45%; border-bottom: 1px solid black;"></div> <div style="width: 50%; border-bottom: 1px solid black; text-align: center;">DATE</div> </div>																											
COMMENTS AND FOLLOW-UP ACTION on page 2																											

page 2

[illegible][illegible][illegible]

Sample – may be modified for specific contracts

POINT SCORE CALCULATION FORM - SAMPLE DESIGN INSPECTION FORM														
Dist:		Comp:	STAND #s:											
			A	B	B	B	B	B	B	B	B	B	B	B
ITEM	ACCURACY STANDARD	POINT VALUE	TOTAL # OF ERRORS (one plot per column)											
Selection Method Type	No errors	Unacceptable												
Sample Expansion Factor	No errors	Unacceptable												
Selection Criteria Number	No errors	Unacceptable												
Subpop Filter	No errors	Unacceptable												
Subpop Variable	No errors	Unacceptable												
Subpop Min Value	No errors	Unacceptable												
Subpop Max Value	No errors	Unacceptable												
Sample Design scoring is Pass/Fail. Any error will result in an Unacceptable Stand and will be returned for correction.														

POINT SCORE CALCULATION FORM - SETTING INSPECTION FORM <i>Sample – may be modified for specific contracts</i>														
Dist:		Comp:	Stand #s:										D - Total Deductions	E - Total Possible Points
		A	B	C	B	C	B	C	B	C	B	C		
ITEM	ACCURACY STANDARD	POINT VALUE	# of Errors	Point Deduction	# of Errors	Point Deduction	# of Errors	Point Deduction	# of Errors	Point Deduction	# of Errors	Point Deduction	(A x sum of B)	(A x # of units inspected)
Proclaimed Region	No errors	Unacceptable												
Proclaimed Forest	No errors	Unacceptable												
Admin. Region	No errors	Unacceptable												
Admin. Forest	No errors	Unacceptable												
District	No errors	Unacceptable												
Location (Comp.)	No errors	Unacceptable												
Setting (Stand)	No errors	Unacceptable												
Ownership	No errors	Unacceptable												
Project Name	No errors	Unacceptable												
Examiner	No errors	Unacceptable												
Date	No errors	Unacceptable												
Examination Level	No errors	Unacceptable												
Exam Purpose	No errors	Unacceptable												
Precision Protocol	No errors	Unacceptable												
State	No errors	Unacceptable												
County	No errors	Unacceptable												
Acres	No errors	2												
Ex. Veg. Reference Code	No errors	Unacceptable												
Existing Vegetation	No errors	Unacceptable												
Structure	No errors	2												
Slope % (avg. for stand)	No errors	2												
Size/Density (User Field)	No errors	2												
Setting Remarks	Complete and accurate 1)	See 1), below												
Sketch Map & Traverse Notes	Complete and accurate	10												
Total Deductions by Setting*			X		X		X		X		X		X	X
Sub-Totals for Setting Data Form (Sum of Total Deductions and Sum of Total Possible Points)														
F - Setting Form Score (Total Deductions / Total Possible Points) X 100 = % Error														
*The total point loss for Setting information shall not exceed Ten points. Eleven points or more will be considered an Unacceptable Stand.														

Setting Inspection Form, continued

1) Setting Remarks Standards

ITEM	ACCURACY STANDARD	POINT VALUE
TLSC	Complete and accurate	-3
Year of Origin	+/-5%	0
	+/-10%	-2
	+/-19%	-5
	If > 19% -->	Unacceptable
Stand Condition	Complete and accurate	-2
Site Index	Complete and accurate	-2
Stand Rx	no deduction	n/a
VT	Complete and accurate	-2
Regen	Complete and accurate	-2
w/in-Stand Features	no deduction	n/a
Stand Damage Category	Each	-2
Stand Damage Agent	Each	-1
Stand Damage Severity	Each	-1
Total / Cumulative Points for Stand Remarks	if > 5 points	Unacceptable

Sample – may be modified for specific contracts**POINT SCORE CALCULATION FORM - PLOT INSPECTION FORM**

Dist: Comp: Stand												D - Total Deductions	E - Total Possible Points	
& Plot #s:		A	B C	B C	B C	B C	B C	B C	B C					
ITEM	ACCURACY STANDARD	POINT VALUE	# of Errors	Point Deduction	# of Errors	Point Deduction	# of Errors	Point Deduction	# of Errors	Point Deduction	# of Errors	Point Deduction	(A x sum of B)	(A x # of units inspected)
Plot Number	No errors	Unacceptable												
Correct No. Plots in Stand	No errors	Unacceptable												
Plot Latitude	No errors	4												
Plot Longitude	No errors	4												
Slope %	Complete and accurate	1												
Existing Vegetation	Complete and accurate For missing entry--->	6 Unacceptable												
Size-density (User Field)	Complete and accurate	2												
Plot locatable; well-flagged, accurate directions.	No errors	Unacceptable												
Remarks (as needed)	Complete and accurate	4												
Total Deductions by Plot*			X		X		X		X		X		X	X
Sub-Totals for Plot Data Form (Sum of Total Deductions and Sum of Total Possible Points)														
F - Plot Form Score (Total Deductions / Total Possible Points) X 100 = % Error														
*The total point loss for Plot setting information shall not exceed nine points. Ten or more points will be considered an Unacceptable Plot.														

Plot Inspection Form, continued

A stand will be ruled as an Unacceptable Stand if the number of Unacceptable Plots exceeds the standards set in the following table:

Total Number of Plots in Stand	Allowable Number of Unacceptable Plots
1-3	No unacceptable plots allowed
4-10	1
11-20	2
21-30	3
>30	plus 1 for every additional 10 plots

Failure to provide plot data for the full number of plots specified in Section J will result in one Unacceptable Plot for each plot not provided, unless previously agreed upon by Contractor and COR.

Sample – may be modified for specific contracts**POINT SCORE CALCULATION FORM - TREE INSPECTION FORM****LARGE SAMPLE PLOT (L.S.) (Trees ≥ 1.0" DBH) - Variable Radius**

Dist: #s:		Comp:	Stand & Plot										D - Total Deductions	E - Total Possible Points
			A	B	C	B	C	B	C	B	C	B		
ITEM	ACCURACY STANDARD	POINT VALUE	# of Errors	Point Deduction	# of Errors	Point Deduction	# of Errors	Point Deduction	# of Errors	Point Deduction	# of Errors	Point Deduction	(A x sum of B)	(A x # of unit inspected)
Plot Number	No errors	Unacceptable												
Tag ID Number	No errors	Unacceptable												
Tree Status	No errors	Unacceptable												
Tree Class	No errors	Unacceptable												
Tree Species	No errors	Unacceptable												
Tree Count	1)	51												
DBH	2)	15												
Site Tree Species (based on matrix)	No errors	Unacceptable												
Site Tree Quality (good quality, dominant or co-dom)	Complete and accurate	20												
Site Tree --Measured to 1/10 inch	+/- 2/10 inch	20												
Tree Height (SI Tree)	± 10 %	20												
Tree Age (SI Tree)	± 10% for trees ≥ 3.0" DBH & ≤ 300 yrs.	20												
	± 15% for all trees > 300 yrs.													
Wildlife Use	Complete and accurate	2												
Snag Decay	± 1 Class	5												
Cut/Residual	Complete and accurate	1												
Damage Category	Each	10												
Damage Agent	Each	5												
Damage Part	Each	5												
Damage Severity	Each	5												
Treatment	Each	1												
Total Tree Deductions by Plot*			X		X		X		X		X		X	X
Sub-Totals for Tree Data Form (Sum of Total Points and Sum of Total Deductions)														
F - Tree Form Score (Total Deductions / Total Points) X 100 = % Error														

*Since the number of plots will vary with stand size, each plot will be evaluated as an entity to determine its acceptability or unacceptability. Within individual plots, a maximum of 100 points may be lost before the PLOT is considered unacceptable.

Tree Inspection Form, variable radius, continued

<i>1) Tree Count Accuracy Standards- BAF Plot</i>		
<u>Tree Count</u>	<u>Accuracy Standard</u>	<u>Point Value per error</u>
1-10	no errors (unacceptable plot)	Unacceptable Plot
11-20	1 tree allowed w/o penalty	51
≥ 20	2 trees allowed w/o penalty	51

<i>2) DBH Accuracy Standards- BAF Plot</i>			
<u>Tree Count</u>	<u>Accuracy Standard</u>	<u>DBH Class</u>	<u>Point Value per error</u>
1-15	1 error allowed w/o penalty	2-inch	15
16+	2 errors allowed w/o penalty	2-inch	15
Any	Four or more DBH class errors (60 pts.) = an Unacceptable Plot	2-inch	Unacceptable Plot

POINT SCORE CALCULATION FORM - TREE INSPECTION FORM																
SMALL SAMPLE PLOT (S.S.) (Trees ≤ 0.9"DBH) -- Small Fixed Area Plot																
Dist:		Comp:		Stand & Plot #s:										D - Total Deductions	E - Total Possible Points	
				A		B	C	B	C	B	C	B	C			
ITEM	ACCURACY STANDARD	POINT VALUE	# of Errors	Point Deduction	# of Errors	Point Deduction	# of Errors	Point Deduction	# of Errors	Point Deduction	# of Errors	Point Deduction	# of Errors	Point Deduction	(A x sum of B)	(A x # of units inspected)
Plot Number	No errors	Unacceptable														
Tag ID Number	No errors	Unacceptable														
Tree Status	No errors	Unacceptable														
Tree Species	No errors	Unacceptable														
Tree Count	1)	51														
DBH	2)	15														
Tree Height	± 10%	20														
Damage Category	No errors	10														
Damage Agent	No errors	5														
Damage Part	No errors	5														
Damage Severity	No errors	5														
Total Tree Deductions by Plot*			X		X		X		X		X		X		X	X
Sub-Totals for Tree Data Form (Sum of Total Points and Sum of Total Deductions)																
F - Tree Form Score (Total Deductions / Total Points) X 100 = % Error																
*Since the number of plots will vary with stand size, each plot will be evaluated as an entity to determine its acceptability or unacceptably. Within individual plots, a maximum of 100 points may be lost before the PLOT is considered unacceptable.																

<i>1) Tree Count Accuracy Standards (small fixed area plot):</i>		
Height Range	Actual Trees On Plot	Accuracy Standard
All**	0	0 trees
0.2 – 1.5 foot	1 - 10	+/- 1 tree
0.2 – 1.5 foot	11 - 50	+/- 10%
0.2 – 1.5 foot	51+	+/- 25%
1.5 - 4.49 foot	1 - 10	+/- 1 tree
1.5 - 4.49 foot	11 - 20	+/- 10%
1.5 - 4.49 foot	21 +	+/- 25%

**There is no tolerance for recording a tree when none are actually present in any of the size classes. The recording of a fixed plot tree when none are present will result in an error.

<i>2) DBH Accuracy Standards:</i>		
Height Range	Actual Trees on Plot	Accuracy Standard
All**	0	0 trees
≥4.5	≥1.0	no errors***

***Any trees recorded by DBH rather than height on a fixed-area plot should be recorded as 1" or less. If greater than 1", then it should be recorded as an overstory plot.

APPENDICES

COMMON STAND EXAM FIELD PROCEDURES

Appendix A: Existing Vegetation Codes (for use in Setting and Plot Data), Descriptions, and Recommended Sample Design

The following table is grouped by broad forest types. Descriptions are provided to facilitate use of correct forest type. The Working Group classification may provide additional information when determining correct forest type. When entering the EV Code at Setting and Plot levels, three digits may be required. (Example: Jack Pine, with an EV Code of "1" would be entered as "001".)

Sample Design shown is the one that would be expected to be used when collecting data in a snow-free season. These are suggested Sample Designs, but another SD may be used, if good reason is given. (Explain in "Setting Remarks".) When Existing Vegetation Reference is needed, use "FSHR9".

EV Code	Forest Type	HNF Working Group	Definitions	Sample Design
White-Red-Jack pine types				
1	Jack Pine	JKP	At least 51% Jack Pine	2
2	Red Pine	RWP	At least 51% Red Pine	2
3	Eastern White Pine	RWP	At least 51% Eastern White Pine	1
4	Eastern White Pine - Hemlock	RWP	Eastern White Pine and Hemlock predominating in a fairly even mix. Different from forest type 5 in that Hardwood is widely absent.	1
6	Scotch Pine	RWP	At least 51% of dominant and codominant trees being Scotch Pine	2
Spruce-Fir-Conifer types				
7	Norway Spruce	SFSC	At least 51% of dominant trees being Norway Spruce	2
8	White Spruce	SFSC	At least 51% of dominant trees being White Spruce. Different from forest type 16 in that Balsam Fir is largely absent.	2
11	Balsam Fir - Aspen / Paper Birch	SFSC	Balsam Fir - Aspen/Paper Birch mix. Different from forest type 95 in that Balsam Fir is the featured species or is dominant in the overstory.	2
12	Black Spruce	SFSC	At least 51% Black Spruce	2
14	Northern White Cedar	CED	At least 51% Northern White Cedar (lowland)	2
15	Tamarack	SFSC	At least 51% Tamarack	2

EV Code	Forest Type	HNF Working Group	Definitions	Sample Design
16	White Spruce - Balsam Fir	SFSC	White Spruce and Balsam Fir predominating in a fairly even mix.	2
17	Upland Black Spruce	SFSC	At least 51% Upland Black Spruce	2
18	Mixed Swamp Conifers	SFSC	Mixed Swamp Conifers in lowlands	2
19	Northern White Cedar - Aspen / Paper Birch	CED	Northern White Cedar and Aspen/Paper Birch predominating in a fairly even mix. (NWC is the featured species or is dominant in the overstory.)	2
22	Upland Northern White Cedar	CED	Upland topography and at least 51% of dominant trees being White Cedar. Different from forest type 14 in that code 14 indicates lowland topography.	2
23	White Spruce - Balsam Fir - Aspen	SFSC	At least 51% of dominant trees being White Spruce. Different from forest type 16 in that Balsam Fir is less present and Aspen is largely present.	2
24	Balsam Fir	SFSC	At least 51% of dominant trees being Balsam Fir. Different from forest type 11 in that Aspen and Paper Birch are largely absent.	2
Oak-Pine types				
41	Eastern White Pine - Northern Red Oak / White Ash	RWP	Eastern White Pine and Northern Red Oak / White Ash predominating in a fairly even mix. (EWP is the featured species or is dominant in the overstory.)	1
43	Oak - Eastern White Pine	HWD	Oak and White Pine predominating in a fairly even mix, or WP slightly predominating. Different from forest types 3 or 4 in that oak is widely present. Different from forest types 55 in that WP is widely present.	1
48	Jack Pine - Oak	JKP	Jack Pine and Oak predominating in a fairly even mix.	1
49	Red Pine - Oak	RWP	Red Pine and Oak predominating in a fairly even mix.	1
Oak types				
47	Oak - Aspen	HWD	Oak and Aspen predominating in a fairly even mix, or Oak slightly predominating. Different from forest types 11, 93 or 94 in that oak is widely present. Different from forest types 55 in that Aspen is widely present.	1
54	White Oak	HWD	At least 51% White Oak	
55	Northern Red Oak	HWD	At least 51% Northern Red Oak	1

EV Code	Forest Type	HNF Working Group	Definitions	Sample Design
60	Oak - Hardwoods	HWD	Oak and Hardwood predominating in a fairly even mix, or Oak slightly predominating. Different from other Hardwood forest types in that oak is widely present. Different from forest type 55 in that other hardwoods are widely present. Different from forest type 80 in that "other hardwoods" in 60 may be mixed.	1
63	Northern Pin Oak	HWD	At least 51% of dominant and codominant trees being Northern Pin Oak.	1
Wet-site Hardwood types				
71	Black Ash - American Elm / Red Maple	HWD	Black Ash and American Elm / Red Maple predominating in a fairly even mix. (Black Ash is the featured species or is dominant in the overstory.)	2
76	Red Maple (wet site)	HWD	At least 51% Red Maple (wet site)	2
77	Green Ash	HWD	At least 51% Green Ash	2
79	Mixed Lowland Hardwoods	HWD	Mixed Lowland Hardwoods	2
Upland Hardwood types				
5	Hemlock	HWD	At least 51% Hemlock	1
42	Eastern Redcedar - Hardwood	CED	Eastern Redcedar and Hardwood predominating in a fairly even mix.	1
20	Northern Hardwoods - Hemlock	HWD	Hardwoods and Hemlock predominating in a fairly even mix. Different from forest type 4 in that White Pine is largely absent. Different from forest type 5 in that Hardwood is widely present.	1
70	Sugar Maple - Black Cherry	HWD	Sugar maple and Black cherry predominating in a fairly even mix. Different from forest types 81, 85 and 89 in that BC is widely present. Different from forest type 83 in that SM is widely present.	1
74	White Ash	HWD	At least 51% of dominant and codominant trees being White Ash.	2
80	Sugar Maple - Northern Red Oak	HWD	Oak and Sugar Maple predominating in a fairly even mix. Different from forest types 81, 85 and 89 in that oak is widely present. Different from forest type 55 in that SM is widely present. Different from forest type 60 in that sugar maple is dominant (non-oak) hardwood.	1
81	Sugar Maple - Beech/ Yellow Birch	HWD	Sugar Maple - Beech/Yellow Birch mix. (Sugar Maple is featured species or dominant in the overstory.) Different from forest type 89 in that ash and Paper birch are less common.	1
82	Sugar Maple - Basswood	HWD	Sugar Maple and Basswood predominating in a fairly even mix.	1

EV Code	Forest Type	HNF Working Group	Definitions	Sample Design
83	Black Cherry - White Ash / Yellow Poplar	HWD	Black Cherry and White Ash/Yellow Poplar predominating in a fairly even mix. (BC is the featured species or is dominant in the overstory.)	1
84	Red Maple (dry site)	HWD	At least 51% Red Maple (dry site)	1
85	Sugar Maple	HWD	At least 51% Sugar Maple	1
86	Beech	HWD	At least 51% Beech	1
88	Black Locust	HWD	At least 51% Black Locust	2
89	Mixed Upland Hardwoods	HWD	Mixed Upland Hardwoods. Different from forest type 81 in that Red Maple, Ash and Paper Birch are more prevalent than Sugar Maple, Beech, or Birch.	1
90	Sugar Maple - Beech/Basswood	HWD	Sugar Maple and Beech-Basswood predominating in a fairly even mix. Different from forest type 82 in that Beech is also widely present.	1
Aspen-Birch types				
73	Cottonwood	ASP	At least 51% Cottonwood	2
91	Quaking Aspen	ASP	At least 51% Quaking Aspen	2
92	Paper Birch	HWD	At least 51% Paper Birch	2
93	Bigtooth Aspen	ASP	At least 51% Bigtooth Aspen	2
94	Balsam Poplar	ASP	At least 51% Balsam Poplar	2
95	Aspen - White Spruce / Balsam Fir	ASP	Aspen - White Spruce / Balsam Fir mix. Different from forest type 11 in that Aspen is the featured stand or is dominant in the overstory.	2
Openings and Brushlands				
97	Lowland Shrubs	OPEN	Only Vegtype 66 is correct with this type (usually tag alder stands)	3
98	Upland Shrubs	OPEN	Only Vegtypes 53 and 55 are correct with this Forest Type	3
99	Open	OPEN	1. Upland Vegtypes 51, 52, 54, 90, 95, 96, 97, 960 and 970, but not Vegtypes 53 or 55. 2. Lowland Vegtypes 62, 63, 64, 65, 68, 70 and 80, but not Vegtype 66.	3

Potential Vegetation References

These codes are not available at this time.

Potential Vegetation Codes

These codes are not used in Region 9 at this time.

Appendix B: NON-FOREST Vegetation Codes (for use in Setting Remarks)

Vegetation Type Codes & Descriptions		
Code	Description (For more detail, see below.)	Cross-reference
050	Upland opening (undifferentiated)	Code 050 not to be used
051	Upland opening grass	Used only with forest type 99
052	Upland opening forb	Used only with forest type 99
053	Upland opening shrub	Used only with forest type 98
054	Savannah	Used only with forest type 99
055	Openings freshly cut that need follow-up work.	Used only with forest type 98
056	Orchard	Used only with forest type 99
060	Wetland (undifferentiated)	Code 060 not to be used
062	Wetland sedge meadow	Used only with forest type 99
063	Wetland shallow marsh	Used only with forest type 99
064	Wetland deep marsh	Used only with forest type 99
065	Wetland open water (= or < 10 acres)	Used only with forest type 99
066	Wetland shrub swamp	Used only with forest type 97
068	Wetland bog	Used only with forest type 99
070	Water lake (open water > 10 acres)	Used only with forest type 99
080	Water stream or river (undifferentiated)	Used only with forest type 99
090	Nonvegetated; rocks, sand, mud	Used only with forest type 99
095	Gravel pit	Used only with forest type 99
950	Settlement	Used only with forest type 99
960	Forested roads	Used only with forest type 99
970	County, State roads	Used only with forest type 99

051 and 052 UPLAND OPENING - HERBACEOUS (grass/forb): An upland supporting perennial grasses, forbs, and sedges with less than 16% stocking of trees and less than 10 percent crown cover of trees. Some dominant species of openings are kingbird, meadow vole, meadowlark and tree swallow. Grouse, wild turkey, and deer are dependent on this vegetation type in spring and summer.

053 UPLAND OPENING – SHRUB: Low woody vegetation dominates and may include witch hazel, chokecherry, elderberry, juneberry, dogwoods, viburnums, sumac, and vaccinium. There is less than 20% stocking of forest tree species. This includes many of our turkey wintering areas that have been heavily planted with shrubs.

054 SAVANNAH: Sparse (i.e. less than 16 to 39 percent stocked; less than 50 sq. ft. basal area) stands of black cherry, oak, other hardwoods, or pine that are valuable as forage areas for deer, turkey, deer mouse, and a variety of raptors. Bluebirds, red-headed woodpeckers, eastern moles, and masked shrews utilize savannahs.

056 ORCHARD: A grassy opening with six or more fruit trees per acre. Characteristic wildlife species are downy woodpecker, sapsucker, cedar waxwing, chickadee, ruffed grouse, bluebird, kingbird, hummingbird, deer, black bear, and bees.

062 and 063 WETLAND - SEDGE MEADOW/SHALLOW MARSH: Seasonally flooded areas, wet meadows, marshes, and swamps. Visible water ranges from very little up to 12 inches in depth. In most years water is present year round. The dominant vegetation

includes rushes, sedges, cattails, and burreed. This vegetation type is utilized heavily by waterfowl, marsh birds, owls, amphibians, herons, sparrows, voles, and muskrats.

064 WETLAND - DEEP MARSH: Wetlands containing 1 to 3 feet of water. Vegetation includes islands of cattails, reeds, bulrushes, spike rushes, and wild rice. This vegetation type is heavily used by waterfowl for feeding and nesting. The mink-muskrat-cattail ecology provides the nucleus for a rich wildlife community.

065 WETLAND - OPEN WATER: Water depth is variable, but less than 10 feet in those areas classed as permanent open water. Emergent vegetation is restricted to a narrow belt around the edge and includes pondweeds, water lillies, coontail and wild rice. The edge may be a floating mat composed of sedges, spagnum, or laborador tea. This type is often used by broods of ducks, although brood cover is not usually well interspersed as in shallow marsh wetlands. This type is also important for attracting and holding migrating waterfowl.

Less than 10 acres will be classed as open water areas. Water areas larger than 10 acres will be classed as lakes. Deeper areas are excellent nurseries for pike, bass, and pan fish. These areas are important to geese, ducks, eagles, ospreys, terns, and gulls. Large beaver ponds are included in the open water classification.

066 WETLAND - SHRUB SWAMP: Areas of saturated ground periodically covered with six inches or more of water. Typical vegetation includes alder, willow, arrowwood, and other shrubs. The use by waterfowl is low unless open areas occur within the dense thickets. Important habitat for woodcock. Grouse deer and herons may also use this vegetation type.

070 WATER LAKE: Open water areas larger than 10 acres will be classified as lakes. Lakes serve as resting and feeding areas for loons, geese, ducks, eagles, and ospreys. A narrow band around the edge is often used for brood rearing if emergent vegetation is present: especially true for diving ducks.

080 WATER - STREAM – RIVER: Slow moving streams and rivers, associated ox-bows and beaver dams provide important habitat for waterfowl, especially woodducks and mergansers.

090 NON-VEGETATED: All areas naturally or artificially void of vegetation, includes extensive rock outcrops, talus, sand beach or dunes, mudflats, and cliffs.

095 GRAVEL PIT: Active and inactive stone and gravel pits. Characterized by disturbed soils usually with cliffs and rock piles present.

Appendix C: Timber Land Suitability Class (TLSC) Codes & Descriptions

TLSC Codes and Descriptions (TLSC in Remarks)	
Code	Description
	Not Forested (Not suited for timber production)
100	Non-meandered water (included as National Forest System ownership)
200	Non-forested land
	Withdrawn
300	Forested land withdrawn from timber production by Congress, the Secretary, or the Chief. Examples: Dukes Experimental Forest, Grand Island, and Dukes Research Natural Areas, wilderness areas and National Historical Register sites.
	Land Suited for Timber Production
500	Forestland suited for timber production based on current technology. Reviewed by O.A. ID teams and determined to be suited for timber production.
	Not Physically Suited
710	OBSOLETE CODE, DO NOT USE. Area cannot be adequately restocked within 5 years. None was identified in the Hiawatha Forest Plan.
720	Irreversible damage most likely to occur. Examples: Areas having steep slopes, unstable soils, unique ecosystems, etc. None was identified in the Hiawatha Forest Plan.
740	There is not adequate information to project responses to timber management practices. Examples: Areas having high water tables, low productivity (lands less than 20 cubic feet growth), etc. The Hiawatha Forest Plan identified 34,000 acres in this category. These acres are primarily lowland conifer/ hardwood types with productivity levels less than 20 cubic feet per acre per year of growth.
	Not Presently Appropriate (Not suited for timber production)
700	OBSOLETE CODE, DO NOT USE.
800	For land in which management objectives preclude timber production. Examples: Areas requiring resource protection to assure that objectives for riparian areas, wildlife habitat, vegetation, threatened and endangered species (eagle/osprey nest zones), etc, are achieved.
801	Unsuitable - other management objectives.
803	Dukes Experimental forest, harvests allowed.
810	For land proposed for resource uses that preclude timber production in order to achieve other multiple-use objectives. Example: Land allocated to management area 6.3 in the Hiawatha Forest Plan where timber production is precluded.
820	Land is not cost efficient in meeting forest objectives. Example: All forestlands within management area 9.1. Other lands that were tentatively suited but later identified by an ID Team as not cost efficient in meeting Forest objectives for timber production over the entire planning horizon (150 years). Simply, these are lands that are not needed to meet timber outputs during the planning horizon.
880	Lands under study pending Congressional, Chief, and/or Secretary of Agriculture action. Example: Wilderness study or roadless areas. On the Hiawatha these are: Candidate Wild and Scenic River (8.4), Candidate wilderness (9.2) and candidate Natural Research Areas.

Appendix D: Stand Prescription – Activity Codes and Descriptions

Enter the codes as a 4-digit numeral, preceded by "A", with no spaces between: "Annnn".

Silviculturally-needed harvests in timbered stands		
<u>ACT</u>	<u>U/M</u>	<u>DESCRIPTION</u>
4111	Acres	Patch Clear-cutting
4112	Acres	Strip Clear-cutting
4113	Acres	Stand Clear-cutting
4114	Acres	Salvage Clear-cutting, mortality
4121	Acres	Prep cut - Shelterwood
4122	Acres	Prep cut - Seed Tree
4131	Acres	Seed cut - Shelterwood
4132	Acres	Seed cut - Seed Tree
4141	Acres	Removal cut - Shelterwood
4142	Acres	Removal cut - Seed Tree
4151	Acres	Selection - Individual Tree (Uneven-aged NH)
4152	Acres	Selection - Group
4210	Acres	Improvement (Selection harvest without 3+ age classes)
4220	Acres	Commercial Thinning
4231	Acres	Selectively Salvage individual trees - mortality
4232	Acres	Selectively Salvage individual trees - sanitation

Silviculturally-needed TSI in timbered stands		
<u>ACT</u>	<u>U/M</u>	<u>DESCRIPTION</u>
032	Acres	Needs additional intensive survey
4431	Acres	Planting - Full
4432	Acres	Planting - Fill in
4492	Acres	Site Preparation for Artificial Regeneration
4493	Acres	Site Preparation for Natural Regeneration
4511	Acres	Release - Individual Tree
4512	Acres	Release - Area
4521	Acres	Precommercial Thinning - Individual tree
4530	Acres	Pruning
4541	Acres	Control understory vegetation - prescribe burn
4542	Acres	Control understory vegetation - hand tools

Opening needs in non-timbered stands		
<u>ACT</u>	<u>U/M</u>	<u>DESCRIPTION</u>
6720	Acres	Opening needs improvement
6725	Acres	Burn upland opening
6730	Acres	Noncommercial clear-cut
6734	Acres	Remove residual stems
6736	Acres	Seed wildlife species
6737	Acres	Plant wildlife species
6743	Acres	Release mast trees or shrubs
6744	Acres	Release fruit trees or shrubs
6745	Acres	Prune fruit trees

Appendix E: Within-Stand Features – Codes and Descriptions

Record 3-digit code preceded by “F”: “Fnnn”.

Stand Feature Codes and Definitions marked with an asterisk (*) are described in greater detail in a second table that follows.

Within Stand Features	
Code	Description for Sensitive Species
210	Eagle nest site
220	Osprey nest site
230	Heron rookery
240	Sandhill crane nesting site
250	Loon nesting lake
260	Osprey nest platform
261	Raptor nest site
262	Goshawk
263	Red Tail Hawk
264	Red Shouldered Hawk
265	Merlin
266	Peregrine Falcon
270	Endangered plants or animals
271	Threatened plants or animals
272	State Special Concern plants or animals
280	Sharp-tailed grouse dancing ground
281	Actual nesting for piping plover

Code	Description for Vegetative Features
400	Thermal cover*
401	Hemlock regeneration present
402	Hemlock component, widely scattered
403	White pine regeneration present
404	White pine component, widely scattered
410	Hard mast
411	Oak regeneration present
412	Oak component, widely scattered
413	Beech regeneration present
414	Beech component, widely scattered
420	Soft mast
421	Black cherry regeneration present
422	Black cherry component, widely scattered
423	Fruit trees
440	Aspen component/inclusion
460	Small opening (unmapped)
470	Unique trees/plants
480	Browse component
481	Den trees
482	Slash
483	Trees in nonforested stand
484	Snags

Code	Description for Geological Features
530	Rock outcrop/cliffs
531	Banks*
540	Esker/kame/kettle
550	Dunes/unstable slope

Within Stand Features	
551	Sand and rock beach*
552	Rock shelters

Code	Description for Recreation
601	Hunter walking trail
602	Cross country ski trail
603	Snowmobile trail
604	Developed recreation site
611	Hunting/fishing/canoe access
612	Hunt/fish parking area
614	Undeveloped campsite*
630	Scenic vista
640	Water falls

Code	Description for Pipelines/Utilities
701	Powerline/phoneline ROW
702	Pipeline ROW
703	Road ROW
705	Radio/Communications/Fire tower site
721	Helipad
722	Airport/landing field
723	Fuelbreak

Code	Description for Water
801	Low-head impoundment
802	Beaver dam - active
803	Beaver dam - inactive
804	Maintained dam*
805	Ditches
811	Pond
812	Spring/seeps
821	Intermittent stream
822	Perennial stream
830	Class I, II trout streams
840	Bog inclusion

Code	Description for Cultural Resource/Other
900	Cultural site (known or possible)*
901	Building or building remains*
902	Mine shaft or test pit*
903	Abandoned dam*
904	Unnatural hole or pit*
905	Bridge or trestle*
906	Trash pile or dump*
911	Abandoned railroad grade*
930	Possible trespasses
940	Research/administrative study sites
950	Special use permit

* Stand Feature Definitions are listed below for items with asterisks

Stand Feature Definitions	
Code	Description
400	Thermal cover - stands or clumps of conifers, usually hemlock, cedar, or balsam, thick enough to moderate effects of wind and snow and available to deer for winter protection.
531	Banks - bank habitat such as in sides of borrow areas or stream banks with nesting sites available.
551	Lake shore, Great Lakes
614	Undeveloped campsite - Unmapped dispersed recreation site, frequently used by camper vehicles, hunters or other visitors.
804	Maintained dam - Current and operational impoundment, usually of timer, concrete, and/or earth.
830	Class I, II trout stream - refer to map.
900	Cultural site (known or possible) - physical evidence of human occupation or use, i.e. artifacts, dumps, holes, pits, structures or foundations.
901	Building or building remains - standing or collapsed cabin, shack, or associated structure of wood, timbers, brick, concrete, etc.
902	Mineshaft or test pit - unnatural hole, trench, or cavity on the surface or in rock outcrops, may contain water and be quite deep.
903	Abandoned dam - deteriorated dam, usually of timber and earth that is not currently maintained for water control.
904	Unnatural hole or pit - surface depression or trench of uncertain origin, possibly related to human occupation or use.
905	Bridge or trestle - standing or collapsed structure, usually of timber or wood, which crosses drainages or other water bodies.
906	Trash pile or dump - any surface debris scatter from human use, along roadsides, associated with old sites, or isolated in the woods.
911	Abandoned railroad - railroad grade no longer in use; tracks and ties may or may not have been removed.

Appendix F: Examples of various Sample Designs

CSE Contracts: Use only Sample Designs in templates provided for contract use.

Example Designs for Measuring Large Trees

Example 1: Sample all (standing live and standing dead) trees 5.0" + DBH with a 10 BAF.

Sample Selection Method	Sample Expansion Factor	Subpop. Filter	Selection Criteria Number	Subpop. Variable	Subpop. Minimum Value	Subpop. Maximum Value
BAF	10	ALL	1	DBH	5.0	999

Example 2: Sample live standing live trees 5.0" + DBH with a 20 BAF.

Sample Selection Method	Sample Expansion Factor	Subpop. Filter	Selection Criteria Number	Subpop. Variable	Subpop. Minimum Value	Subpop. Maximum Value
BAF	20	LIVE	1	DBH	5.0	999

Example 3: Sample standing dead trees 10.0" + DBH with a 10 BAF.

Sample Selection Method	Sample Expansion Factor	Subpop. Filter	Selection Criteria Number	Subpop. Variable	Subpop. Minimum Value	Subpop. Maximum Value
BAF	10	DEAD	1	DBH	10	999

Example 4: Sample standing live trees 5.0" + DBH or 3.0" + DRC on a 10th acre plot.

Sample Selection Method	Sample Expansion Factor	Subpop. Filter	Selection Criteria Number	Subpop. Variable	Subpop. Minimum Value	Subpop. Maximum Value
FRQ	10	LIVE	1	DBH	5	999
		LIVE	2	DRC	3	999

Example Designs for Measuring Small Trees

Example 1: Sample standing live and standing dead trees .1-4.9" DBH, **also** sample live trees .5'- 4.4' in height on a 100th acre plot.

Sample Selection Method	Sample Expansion Factor	Subpop. Filter	Selection Criteria Number	Subpop. Variable	Subpop. Minimum Value	Subpop. Maximum Value
FRQ	100	ALL	1	DBH	.1	4.9
		LIVE	2	HGT	.5	4.4

Example 2: Sample standing live trees 1.0-4.9" DBH or 1.0-2.9" DRC on a 50th acre plot.

Sample Selection Method	Sample Expansion Factor	Subpop. Filter	Selection Criteria Number	Subpop. Variable	Subpop. Minimum Value	Subpop. Maximum Value
FRQ	50	LIVE	1	DBH	1.0	4.9
		LIVE	2	DRC	1.0	2.9

Example 3: Sample stumps 10.0"+ diameter at root collar on a 10th acre plot.

Sample Selection Method	Sample Expansion Factor	Subpop. Filter	Selection Criteria Number	Subpop. Variable	Subpop. Minimum Value	Subpop. Maximum Value
FRQ	10	STUMPS	1	DRC	10	999

Example 4: On a 300th acre plot, 1) sample all (standing live and standing dead) trees 3.0-4.9" DBH EXCEPT aspen; 2) sample standing live trees 0.1-2.9" DBH and .5-4.9' high EXCEPT aspen; and 3) sample standing live aspen 1.0-4.9' in height.

Sample Selection Method	Sample Expansion Factor	Subpop. Filter	Selection Criteria Number	Subpop. Variable	Subpop. Minimum Value	Subpop. Maximum Value
FRQ	300	All	1	DBH	3	4.9
		POTR5-A	1	SPP	999	
		LIVE	2	DBH	0.1	2.9
		LIVE	2	HGT	.5	4.9
		POTR5-A	2	SPP	999	
		POTR5-L	3	HGT	1.0	4.9

Example Designs for Measuring Down Woody Material

Example 1: Use Brown's protocols. Using a 7' transect, record the number of pieces on each of the three intersection diameter classes (0.1-.24, .25-.99, and 1.0-2.9). Using a 27' transect, record information on all pieces 3.0"+ in intersection diameter.

Sample Selection Method	Sample Expansion Factor	Subpop. Filter	Selection Criteria Number	Subpop. Variable	Subpop. Minimum Value	Subpop. Maximum Value
TRN	7	DOWN	1	DIA	0.1	.24
		DOWN	2	DIA	.25	.99
		DOWN	3	DIA	1.0	2.99
TRN	27	DOWN	4	DIA	3.0	999

Example 2: Using fuel photos, estimate per acre down material volume and weight values for three size classes.

Sample Selection Method	Sample Expansion Factor	Subpop. Filter	Selection Criteria Number	Subpop. Variable	Subpop. Minimum Value	Subpop. Maximum Value
FRQ	1	DOWN	1	DIA	.01	3.0
		DOWN	2	DIA	3.1	5.0
		DOWN	3	DIA	5.1	999

Appendix G: Species Codes (for use in Tree Data)**Draft HNF List**

R9SS = sensitive (Federal/Region 9); **NOX** = noxious

MI-T = Michigan threatened; **MI-S** = Michigan sensitive)

Note: To find codes for other species, check the plants website at:

<http://plants.usda.gov>

Tree			
Scientific Name	Common Name	Symbol	Status
<i>Abies balsamea</i>	Balsam Fir	ABBA	
<i>Acer pensylvanicum</i>	Striped maple	ACPE	
<i>Acer rubrum</i>	Red maple	ACRU	
<i>Acer saccharinum</i>	Silver maple	ACSA2	
<i>Acer saccharum</i>	Sugar maple	ACSA3	
<i>Betula alleghaniensis</i>	Yellow birch	BEAL2	
<i>Betula nigra</i>	River birch	BENI	
<i>Betula papyrifera</i>	Paper birch	BEPA	
<i>Carpinus caroliniana</i>	American hornbeam, musclewood	CACA18	
<i>Carya cordiformis</i>	Bitternut hickory	CACO15	
<i>Cornus L.</i>	Dogwood	CORNU	
<i>Crataegus L.</i>	Hawthorn	CRATA	
<i>Elaeagnus angustifolia</i>	Russian olive	ELAN	NOX
<i>Fagus granifolia</i>	American Beech	FAGR	
<i>Fraxinus americana</i>	White ash	FRAM2	
<i>Fraxinus nigra</i>	Black ash	FRNI	
<i>Fraxinus pennsylvanica</i>	Green ash	FRPE	
<i>Juglans cinerea</i>	Butternut	JUCI	R9SS
<i>Juglans nigra</i>	Black walnut	JUNI	
<i>Larix laricina</i>	Tamarack	LALA	
<i>Malus</i>	Apple	MALUS	
<i>Ostrya virginiana</i>	Ironwood, Hophornbeam	OSVI	
<i>Picea abies</i>	Norway spruce	PIAB	
<i>Picea glauca</i>	White spruce	PIGL	
<i>Picea mariana</i>	Black spruce	PIMA	
<i>Pinus resinosa</i>	Red pine	PIRE	
<i>Pinus strobus</i>	Eastern white pine	PIST	
<i>Pinus sylvestris</i>	Scotch pine	PISY	
<i>Populus grandidentata</i>	Bigtooth aspen	POGR4	
<i>Populus tremuloides</i>	Quaking aspen	POTR5	
<i>Prunus pensylvanica</i>	Pin cherry	PRPE2	
<i>Prunus serotina</i>	Black cherry	PRSE2	
<i>Quercus alba</i>	White oak	QUAL	
<i>Quercus rubra</i>	Northern red oak	QURU	
<i>Quercus velutina</i>	Black oak	QUVE	
<i>Robinia pseudoacacia</i>	Black locust	ROPS	
<i>Salix L.</i>	Willow	SALIX	
<i>Tilia americana</i>	American basswood	TIAM	
<i>Tsuga canadensis</i>	Eastern hemlock	TSCA	
<i>Ulmus americana</i>	American elm	ULAM	
<i>Ulmus rubra</i>	Slippery elm	ULRU	
DO NOT USE THIS CODE	Tree, deciduous	2TD	
DO NOT USE THIS CODE	Tree, evergreen	2TE	

Appendix H: Key to Tree Species

SOFTWOODS			
1	Leaves needle shaped, in fascicles of 1-5 each enclosed at base by a sheath; whole region	PINUS	Pine
1	Leaves single, linear or scale like	2	
2	Leaves mostly linear; leaves and fruit scales spirally arranged	3	
2	Leaves mostly scale like; leaves and fruit scales opposite	7	
3	Cones scales peltate; seed laterally winged, 2 seeds under each scale; leaves deciduous, scale like, appearing 2-ranked; typical in swamps; Illinois, Indiana, Maryland, Missouri, New Jersey, New York, Ohio, and Pennsylvania,	TADI2	Bald cypress
3	Cone scales thin, terminally attached; seed terminally winged; 2 to each side	4	
4	Twigs with spur shoots; cones upright, maturing in one year, seeds are winged; leaves deciduous, needlelike, pale blue-green, produced in clusters on short shoots or singly along the long shoots; not found in Delaware, Iowa, or Missouri	LALA	Tamarack
4	Twigs without spur shoots; cones upright or pendent, maturing in one year	5	
5	Leaves not leaving peg like bases on twigs upon falling, sessile flattened, dark shiny green above, silvery banded below, $\frac{3}{4}$ -1½ inch long, blunt or slightly notched at the apex, 2-ranked; cones erect, scales deciduous from axis at maturity, 2-3½ inches long, green tinged with purple; buds rounded, resinous; not found in Delaware, Illinois, Indiana, or New Jersey	ABBA	Balsam fir
5	Leaves leaving peg like bases on twigs upon falling	6	
6	Leaves sessile, 4-angled or flattened; not found in Indiana, Iowa, or Missouri	PICEA	Spruce
6	Leaves stalked, flat, or rounded in cross section; not found in Illinois, Iowa, or Missouri	TSUGA	Hemlock
7	Cone berry like, dark blue, seed wingless; leaves scale like, dark green, acute, 1/16-inch long, smooth margined, glandular; whole region	JUVI	Eastern redcedar
7	Cone sub-woody or leathery, erect, ½ inch long, 4 scaled; leaves scale like, persistent 2-5 years, the facial leaves flattened, grooved, the lateral leaves rounded or keeled, glandular pitted; seed winged; not found in Delaware or Missouri	THOC2	Northern white cedar

SOFTWOODS			
KEY TO THE SPECIES OF PICEA (Spruce)			
1	Cone scales wedge shaped at tip, margin wavy, cones 4-7 inches long; needles 4-sided; not found in Delaware, Indiana, Iowa, or Missouri	PIAB	Norway
1	Cone scales rounded at tip, smooth or wavy margin	2	
2	Cones ½-1½ inch long, persistent many years, purple; needles blunt, spreading in all directions, 4-angled, pale blue-green and glaucous, broad bands of stomata on upper surface; Connecticut, Illinois, Maine, Massachusetts, Michigan, Minnesota, New Hampshire, New Jersey, New York, Pennsylvania, Rhode Island, Vermont, and Wisconsin	PIMA	Black
2	Cones 1¼-2 inches long, falling after 1 year, brown, needles pointed	3	
3	Cone scales stiff and rigid; twigs hairy; needles extending at nearly right angles from all sides of the twig, ½-5/8 inch long, yellow-green; Connecticut, Delaware, Maine, Maryland, Massachusetts, New Hampshire, New Jersey, New York, Pennsylvania, Vermont, and West Virginia	PIRU	Red

SOFTWOODS			
KEY TO THE SPECIES OF PICEA (Spruce)			
3	Cone scales soft and flexible; twigs not hairy; needles crowded on upper side of branch, 1/3-3/4 inch long, blue-green, occasional whitish tinge, odor pungent when crushed; Connecticut, Maine, Maryland, Massachusetts, Michigan, Minnesota, New Hampshire, New York, Pennsylvania, Rhode Island, Vermont, and Wisconsin	PIGL	White

SOFTWOODS			
KEY TO THE SPECIES OF PINUS (Pines)			
1	Needles in clusters of 5, 2-4 inches long, cluster sheath deciduous, absent on mature needles; cone scales without prickles, cones 4-8 inches long, scales flexible; not found in Missouri	PIST	Eastern white
1	Needles in clusters of 2 or 3, cluster sheath persistent, cone scales usually armed with prickles	2	
2	Eastern hard pines; Northeastern and central states	3	
2	Southern yellow pines; Gulf and South Atlantic states	7	
3	Needles in 3's, 3-5 inches long, twisted, nearly right angles to twig; cones 1 1/2-3 1/2 inches long, persistent on branch, scales armed with short, rigid prickle; not found in Iowa, Michigan, Missouri, or Wisconsin	PIRI	Pitch
3	Needles in 2's	4	
4	Needles 4-6 inches long; cones symmetrical, 1 1/2-2 1/2 inches long Connecticut, Delaware, Illinois, Indiana, Iowa, Maine, Maryland, Massachusetts, Michigan, Minnesota, Missouri, New Hampshire, New Jersey, New York, Ohio, Pennsylvania, Rhode Island, Vermont, West Virginia, and Wisconsin, whole Region	PIRE	Red
4	Needles 1-3 inches long	5	
5	Bark distinctly orange colored; cones falling when ripe, scales often pyramidally thickened; needles twisted, stout, blue-green; not found in Delaware, Iowa, Missouri, or Ohio	PISY	Scotch
5	Bark not orange colored; cones long persistent; scales not pyramidally thickened	6	
6	Cones strongly incurved, commonly remaining closed, less than 1 inch long; scales irregularly developed; needles 3/4-1 1/2 inches long, yellow-green; not found in Connecticut, Delaware, Iowa, Maryland, Missouri, or New Jersey	PIBA2	Jack
6	Cones symmetrical, opening at maturity, 1-3 inches long; needles 1 1/2-3 inches long, gray-green; found in Connecticut, Delaware, Indiana, Maryland, Missouri, New Jersey, New York, Ohio, and Pennsylvania	PIV2	Virginia
7	Needles 3-5 inches long, in 2's and 3's; cone 1-2 inches long, sharp prickle; dry soils; bark characteristic resin holes or pockets Connecticut, Delaware, Illinois, Indiana, Iowa, Maine, Maryland, Massachusetts, Michigan, Minnesota, Missouri, New Hampshire, New Jersey, New York, Ohio, Pennsylvania, Rhode Island, Vermont, West Virginia, and Wisconsin, whole Region	PIEC2	Shortleaf
7	Needles 6-9 inches long, in 3's; cone 2-6 inches long, stout sharp spine; found in Delaware, Illinois, Maine, Maryland, Missouri, New Jersey, New York, Ohio, Pennsylvania, and West Virginia	PITA	Loblolly

HARDWOODS			
1	Leaves and buds opposite	2	
1	Leaves and buds alternate	4	
2	Leaves simple	3	
2	Leaves compound	6	
3	Leaves palmately lobed; fruit a double samara; whole Region	ACER	Maple
3	Leaves not lobed, fruit not a double samara; whole Region	CORNU	Dogwood

HARDWOODS			
4	Leaves compound	I	
4	Leaves simple	5	
5	Leaves lobed	II	
5	Leaves entire	III	
5	Leaves toothed	IV	
6	Leaves palmately compound; fruit a capsule; whole Region except Vermont	AESCU	Buckeye
6	Leaves pinnately compound or 3-foliate	7	
7	Leaflets entire or finely toothed; fruit a samara; whole Region	FRAXI	Ash
7	Leaflets deeply and sharply toothed; fruit a double samara in racemes; whole Region	ACNE2	Boxelder

HARDWOODS			
I. Leaves alternate and compound			
1	Fruit a legume; leaves 1 to many pinnate	2	
1	Fruit not a legume	4	
2	Leaves bipinnately compound, 6-12 inches long, leaflets ½-1½ inches long; flowers regular or nearly so, in racemes, stamens 10 or less, filaments free; fruit twisted legume 12-18 inches long and 1 inch wide, containing 12-14 dark brown oval seeds; whole Region	GLTR	Honeylocust
2	Leaves simple or pinnately compound;	3	
3	Leaflets 3-4 inches long, 7-9 leaflets; flowers white, in panicles slightly fragrant, 12-14 feet long and 5-6 feet wide; legume thin, 1-3 inches long; rare; Connecticut, Illinois, Indiana, Maine, Massachusetts, Missouri, New York, Ohio, Pennsylvania, and Rhode Island	CLKE	Kentucky yellowwood
3	Leaves pinnately compound, 7-21 leaflets 1-2½ inches long; twigs with stipular spines; legumes compressed, not constricted, 2-4 inches long; whole Region	ROPS	Black locust
4	Pith conspicuously chambered; fruit a nut like drupe; whole Region	JUGLA	Walnut
4	Pith solid; fruit not as above	5	
5	Leaves 1½-4 feet long, 13-25 leaflets with dark green gland on coarse teeth; fruit a samara with twisted wing; listed as an invasive weed; found in disturbed areas, waste places, roadsides and around buildings; whole Region except Minnesota, New Hampshire, and Vermont	AIAL	Tree of heaven
5	Leaves smaller or leaflets without glands; stipules absent; buds large; fruit a nut like drupe; whole Region	CARYA	Pecan and Hickory

HARDWOODS			
II. Leaves alternate, simple, deciduous, and lobed			
1	Leaves 4 lobed representing a tulip in outline; bud large with valvate scales; fruit a large, erect, cone like aggregate of spirally arranged samaras, bark smooth; whole Region except Maine, Minnesota, New Hampshire, and Wisconsin	LITU	Tuliptree
1	Leaves not 4 lobed; bud scales not valvate	2	
2	Leaves deeply and palmately 3-7 lobed, finely toothed, star shaped; fruit in multiple heads of capsules; terminal bud scaly; twigs with corky wings; bark deeply furrowed; frequently buttressed bole; whole Region except Iowa, Maine, Michigan, Minnesota, New Hampshire, Vermont, and Wisconsin	LIST2	Sweetgum
2	Leaves not palmately 3-7 lobed; fruit an acorn; leaf scars with many bundle traces; whole Region	QUERC	Oak

HARDWOODS			
III. Leaves alternate, simple, deciduous, and entire			
1	Leaves, twigs, and drupes silvery-scurfy, leaves lanceolate; branches often spiny; flower drupe ½ inch long; noxious plant; whole Region except Delaware, Indiana, New Hampshire, Vermont, and West Virginia	ELAN	Russian olive
1	Plants not silvery-scurfy	2	
2	Terminal bud present, conspicuous	3	
2	Terminal bud absent; lateral buds often minute	7	
3	Terminal bud large, with single cap like scale; leaves broadly elliptical to ovate, 6-10 inches long, thin, bright yellow-green above; fruit cone like aggregate; not found in Delaware, Iowa, Michigan, Minnesota, New Hampshire, Rhode Island, Vermont, and Wisconsin	MAAC	Cucumber-tree
3	Terminal bud scaly; leaves 1-7 inches long; fruit simple	4	
4	Stipules present; fruit an acorn; whole Region	QUERC	Oak
4	Stipules absent; fruit not an acorn	5	
5	Leaves with arcuate veins; petioles long and slender; flowers small in cymes; fruit a drupe; whole Region	CORNU	Dogwood
5	Leaves with pinnate veins; petioles short	6	
6	Leaves oblong to obovate, 2-7 inches long; pith diaphragmed; fruit an oblong, fleshy drupe; whole Region except Iowa and Minnesota	NYSSA	Nyssa
6	Leaves oblong, 2-4 inches long; pith solid; fruit a capsule; southeastern coastal plain	7	
7	Leaves unequal at base, 2½-4 inches long; pith chambered at nodes; fruit a dry drupe, dark red or purple, bark characteristic corky warts or ridges; grows best on moist alluvial soils, and occurs only as scattered trees mixed with other hardwoods; whole Region except Maine	CEOC	Common hackberry
7	Leaves equal at base; pith solid; fruit not a dry drupe	8	
8	Stipules absent; twigs not spinescent, spur shoots absent; leaves glabrous; fruit a large plum-like berry subtended by woody persistent calyx; southern part of the Region including Connecticut, Delaware, Illinois, Indiana, Iowa, Maryland, Massachusetts, Missouri, New Jersey, New York, Ohio, Pennsylvania, and West Virginia	DIOSP	Persimmon
8	Stipules or their scars present	9	
9	Buds, single cap-like scale; fruit a capsule; whole Region	SALIX	Willow
9	Buds naked or scaly; fruit a drupe, ¼-½ inch long; leaves 1-7 inches long; sap watery; whole region except Maryland and West Virginia	RHCA3	Common buckthorn

HARDWOODS			
IV. Leaves alternate, simple, deciduous, and toothed			
1	Buds naked, terminal present; leaves 4-6 inches long, unequal at base, oval, crenately toothed; flowers yellow, appearing in fall; fruit a capsule; whole Region	HAMAM	Witchhazel
1	Buds scaly, sometimes naked, flowers in spring	2	
2	Fruit a nut in a bur or cup; leaves mostly penni-veined	3	
2	Fruit not in bur or cup	4	
3	Buds lance shaped, ¾-1 inch long, terminal present; nut triangular in spiny bur; bark thin, smooth, blue-gray; leaves convex, thick and firm; whole Region except Iowa, and Minnesota	FAGUS	Beech
3	Buds ovoid to globose 1/8-1/4 inch long, many scaled; fruit rounded in a scaly cup; leaves with rounded or short teeth; whole Region	QUERC	Oak
4	Fruit a nut or nutlet in strobile or leafy involucre; terminal bud absent	5	
4	Fruit in a samara, capsule, pome, or drupe	6	
5	Nutlets winged in deciduous strobile; bark with horizontal lenticels, often papery; whole Region	BETUL	Birch

HARDWOODS			
IV. Leaves alternate, simple, deciduous, and toothed			
5	Fruit a nutlet, numerous nutlets held together in pendulous chain-like clusters, unwinged; bark not papery, smooth, blue-gray; stem fluted; whole Region	CACA18	American hornbeam
6	Leaves unequal at base; fruit a samara or woody drupe; terminal bud absent	7	
6	Leaves equal at base; fruit a capsule, pome, or drupe	8	
7	Fruit a smooth, oval, winged samara; leaves coarsely mostly double serrate, 4-6 inches long, thick and firm; moist sites; whole Region	ULAM	American elm
7	Fruit a drupe, juicy; leaves thin, singly serrate, 1½-2½ inches long, 8-10 pairs of veins; winter buds naked; twigs often spinescent; noxious plant; whole Region except Delaware and Missouri	FRAL4	Glossy buckthorn
8	Fruit a capsule	9	
8	Fruit a pome or drupe	10	
9	Buds scaly, terminal present; whole Region	POPUL	Cottonwood
9	Buds, single cap like scale, terminal absent; whole Region	SALIX	Willow
10	Leaf base unequally heart-shaped, leaf 5-6 inches long; fruit gray, woolly nutlike drupe attached to persistent, leafy bract; whole Region	TILIA	Basswood
10	Leaf base not heart shaped, no persistent leafy bract, leaves mostly lanceolate; fruit a drupe; whole Region	PRUNU	Plum

HARDWOODS			
KEY TO THE SPECIES OF ACER (Maple)			
1	Leaves with closely, often doubly, toothed margins, sharp sinuses between lobes	2	
1	Leaf lobes entire or with few remote teeth, rounded sinuses	4	
2	Flowers appear with/after leaves, 2-4 bud scales, in racemes, yellow-green; fruit matures in late summer; leaves hairy beneath, 3 shallow and broad terminal lobes, serrate margins; bark green with conspicuous white vertical stripes; whole Region except Delaware, Illinois, Indiana, Iowa, Missouri	ACPE	Striped
2	Flowers appear before leaves, 4-8 visible bud scales, fruit matures late spring	3	
3	Leaves deeply 5-lobed, silver-white beneath 4-6 inches in diameter; twigs with rank odor; whole Region	ACSA2	Silver
3	Leaves 3-5 lobed, pale green beneath, 2½-4 inches in diameter; twigs no rank odor; whole Region	ACRU	Red
4	Leaves 5-7 lobed, petioles red with milky juice; fruit wings widely diverging; invasive weed; whole Region except Iowa and Missouri	ACPL	Norway
4	Leaves 3-5 lobed, petioles with watery juice; fruit wings at right angles or less; whole Region	ACSA3	Sugar

HARDWOODS			
KEY TO THE SPECIES OF BETULA (Birch)			
1	Leaves 9-12 pairs of veins, fruit erect, twigs with wintergreen flavor	2	
1	Leaves 8 or less pairs of veins, fruit peduncle, twigs without wintergreen flavor	3	
2	Bark dark, furrowed, not separating into papery layers; leaves singly serrate, heart shaped; Not found in Illinois, Indiana, Iowa, Michigan, Minnesota, Missouri, and Wisconsin	BELE	Sweet
2	Bark dirty yellow, scaly, separating into thin, papery layers; leaves sharply doubly toothed, with scattered, minute, resinous glands; whole Region except Missouri	BEAL2	Yellow
3	Bark dark-brown to chestnut brown; leaves 1-3 inches long, serrated edges; whole Region except Maine and Rhode Island	BENI	River

HARDWOODS			
KEY TO THE SPECIES OF BETULA (Birch)			
3	Bark distinctly white in color, inner bark orange; whole Region except Delaware and Missouri	BEPA	Paper

HARDWOODS			
KEY TO THE SPECIES OF FRAXINUS (Ash)			
1	Body of fruit compressed; wing extending to seed base; leaves 12-16 inches long, with 7-11 leaflets each 3-5 inches long; bark gray, becoming corky-ridged and shallowly furrowed, with thin, papery scales that rub off easily; whole Region except Missouri	FRNI	Black
1	Body of fruit nearly terete, wing not extending to base	2	
2	Leaflets 5-9, crenellate-serrate to entire, glabrous, dark green above; twigs nearly glabrous, leaf scars notched at top; bark thick, gray, closely fissured, narrow ridges around diamond shaped areas; whole Region	FRAM2	White
2	Leaflets 7-9, sharply serrate, at least above middle, glabrous to hairy below, yellow-green above; twigs glabrous to hairy, leaf scar truncate to slightly notched; bark thin, brown, shallow fissures and scaly ridges; whole Region	FRPE	Green

HARDWOODS			
KEY TO THE SPECIES OF JUGLANS (Walnut)			
1	Fruit ovoid-oblong nut in cluster of 3-5; band of pale hair separating leaf scar from bud; leaflets 11-17, oblong-lanceolate; whole Region	JUCI	Butternut
1	Fruit globose nut, solitary or in pairs, 1½-2 inches in diameter; buds not separated by hairy band from leaf scar; nut deeply ridged; 15-23 stemless leaflets, 1-2 feet long; whole Region except New Hampshire and Vermont	JUNI	Black

HARDWOODS			
KEY TO THE SPECIES OF POPULUS (Cottonwood, Poplar, and Aspen)			
1	Leaf petiole round in cross section, leaf base round or heart shaped, 3-6 inches long, 2-4 inches broad; capsule 2-valved; flowers 20-30 pink stamens, bark on young trunks smooth and green-brown; on large trunks deeply furrowed and gray-black; whole Region except Missouri and New Jersey	POBA2	Balsam poplar
1	Leaf petiole definitely flattened laterally	2	
2	Leaves finely toothed, ½-3 inches in diameter; buds glabrous; twigs slender; whole Region except Delaware	POTR5	Quaking aspen
2	Leaves coarsely sinuate-toothed, 2-5 inches long; buds hairy; twigs stout; whole Region	POGR4	Bigtooth aspen

HARDWOODS			
KEY TO THE SPECIES OF PRUNUS (Cherry and chokecherry)			
1	Leaves sharply and coarsely serrate with incurved teeth, 3-4 inches long; fruit light red, thick skinned, thin flesh, quite sour; whole Region except Delaware and Missouri	PRPE2	Pin cherry
1	Leaves finely toothed with incurved callous teeth, 2-6 inches long; fruit nearly black, slightly bitter; whole Region	PRSE2	Black cherry

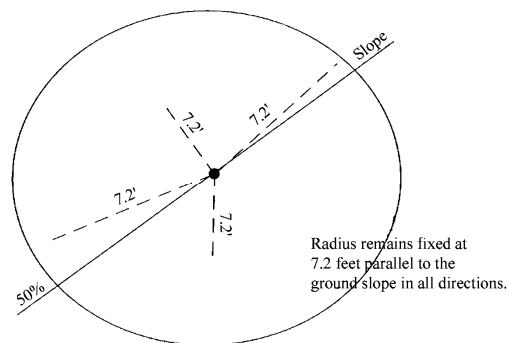
HARDWOODS			
KEY TO THE SPECIES OF QUERCUS (Oak)			
1	Leaves or lobes commonly bristle-tipped, rarely broadly ovate and entire; acorn maturing in 2 years, usually bitter; nut shell wooly inside	7	
1	Leaves or leaf lobes not bristle-tipped; acorn maturing in 1 year, usually sweet; nut shell smooth inside	3	
3	Leaves deeply lobed or rarely entire	5	
3	Leaves coarsely toothed or shallowly lobed	4	
4	Leaves obovate, 3-4½ inches wide, white hairy below and dark green above; acorn 1-1½ inches long in thick, sessile cup with distinct wedge shaped scales; moist, wet often inundated sites; Southern part of the Region including Delaware, Illinois, Indiana, Maryland, Missouri, New Hampshire, and New Jersey	QUMI	Swamp chestnut
4	Leaves elliptical, 1½-3 inches wide, slightly hairy below and yellow-green above; acorn in thin cup with partially fused scales; poor, dry sites; whole Region except Iowa, Minnesota, Missouri, and Wisconsin	QUPR2	Chestnut
5	Acorns enclosed ¼-½ of length, in un-fringed cup with thickened warty scales; leaves 5-9 inches long, regularly, usually deeply, 7-9 lobed, glabrous below; buds nearly glabrous; whole Region	QUAL	White
5	Acorns enclosed in cup, or cup fringed	6	
6	Acorn cup conspicuously fringed on margin; leaves nearly divided in two by deep sinuses; whole Region	QUMA2	Bur
6	Acorn cup not fringed, thin, nearly covering acorn; leaves irregularly lobed; wet, poorly drained clay soils; found in Delaware, Illinois, Indiana, Maryland, Missouri, and New Jersey	QULY	Overcup
7	Leaves white to red woolly below, lobed in 2 ways often on same tree: 1) shallowly 3-lobed at apex, 2) deeply and irregularly 5-7 lobed; southern part of Region including Delaware, Illinois, Indiana, Maryland, Missouri, New Jersey, Ohio, Pennsylvania, and West Virginia	QUFA	Southern red
7	Leaves elliptic to oblong; sinuses rounded in the bottom into 5-11 acuminate, entire lobes spreading at right angles; southern part of Region including Delaware, Illinois, Indiana, Maryland, Missouri, and New Jersey	QUPA5	Cherrybark
7	Leaves green below, often with hairy tufts in axils	8	
8	Leaves dull, 7-11 lobed, sinus extending about ½ way to midrib 5-9 inches long; whole Region	QURU	Northern red
8	Leaves lustrous, mostly 5-7 lobed, sinus extending over ½ way to midrib	9	
9	Acorn cup with loosely imbricated scales; winter buds woolly; leaves 5-9 inches long; whole Region	QUVE	Black
9	Acorn cup with tightly imbricated scales; winter buds not woolly	10	
10	Buds white-hairy; acorn with distinctive rings near apex, white kernel; leaves 3-7 inches long; dry, sandy sites; whole Region except Iowa and Minnesota	QUCO2	Scarlet
10	Buds not white-hairy; acorn without rings, yellow kernel; leaves 3-6 inches long; many short pin like branches; moist sites; northwestern part of Region including Illinois, Indiana, Iowa, Michigan, Minnesota, Missouri, Ohio, and Wisconsin	QUEL	Northern pin

Appendix I: Fixed Radius Plot

There are two methods to determine the correct plot radius on a slope:

1. Correct the fixed plot radius for slope percent using the "Circular Plot Radii Corrected for Slope" table and then measuring distances parallel to the ground line. This method always results in a circular plot on the slope.

Example - 1/300 acre fixed plot on 50 percent slope. Corrected fixed plot radius is 7.2 feet.



Circular Plot Radii Corrected for Slope – Plot Size in Acres						
SLOPE %	1/300	1/100	1/50	1/20	1/10	1/5
0-9	6.8	11.8	16.7	26.3	37.2	52.7
10-17	6.8	11.8	16.7	26.5	37.4	52.9
18-22	6.9	11.9	16.8	26.6	37.6	53.2
23-26	6.9	12	16.9	26.7	37.8	53.4
27-30	6.9	12	17	26.9	38	53.7
31-33	7	12.1	17.1	27	38.2	54
34-36	7	12.1	17.1	27.1	38.3	54.2
37-39	7	12.2	17.2	27.2	38.5	54.5
40-42	7.1	12.2	17.3	27.4	38.7	54.7
43-44	7.1	12.3	17.4	27.5	38.9	55
45-47	7.1	12.3	17.5	27.6	39.1	55.2
48-49	7.2	12.4	17.5	27.7	39.2	55.5
50-51	7.2	12.5	17.6	27.9	39.4	55.7
52-53	7.2	12.5	17.7	28	39.6	56
54-55	7.3	12.6	17.8	28.1	39.8	56.2
56-57	7.3	12.6	17.9	28.2	39.9	56.5
58-59	7.3	12.7	17.9	28.4	40.1	56.7
60-61	7.4	12.7	18	28.5	40.3	57
62-63	7.4	12.8	18.1	28.6	40.4	57.2
64-65	7.4	12.8	18.2	28.7	40.6	57.4
66-67	7.4	12.9	18.2	28.8	40.8	57.7
68-69	7.5	13	18.3	29	41	57.9
70	7.5	13	18.4	29.1	41.1	58.2
71-72	7.5	13.1	18.5	29.2	41.3	58.4
73-74	7.6	13.1	18.5	29.3	41.5	58.6
75	7.6	13.2	18.6	29.4	41.6	58.7
76-77	7.6	13.2	18.7	29.6	41.8	59.1
78-79	7.7	13.3	18.8	29.7	42	59.3

Circular Plot Radii Corrected for Slope – Plot Size in Acres						
SLOPE %	1/300	1/100	1/50	1/20	1/10	1/5
80	7.7	13.3	18.8	29.8	42.1	59.6
81-82	7.7	13.4	18.9	29.9	42.3	59.8
83	7.8	13.4	19	30	42.5	60
84-85	7.8	13.5	19.1	30.1	42.6	60.3
86	7.8	13.5	19.1	30.3	42.8	60.5
87-88	7.8	13.6	19.2	30.4	42.9	60.7
89	7.9	13.6	19.3	30.5	43.1	61
90-91	7.9	13.7	19.3	30.6	43.3	61.2

2. Determine the slope limiting distance to borderline trees by using the "Slope Correction Table". (The slope being corrected is the slope from plot center to the tree, not the overall plot slope.). Measure the distance parallel to the ground line to the borderline tree. This method always results in an oval plot on the slope. Following is a list of fixed plot sizes and the specific radius for each:

Plot Size	Plot Radius	Plot Size	Plot Radius	Plot Size	Plot Radius
1/1000	3.7 feet	1/250	7.4 feet	1/5	52.7 feet
1/750	4.3 feet	1/200	8.3 feet	1/4	58.9 feet
1/700	4.5 feet	1/150	9.6 feet	1/3	67.6 feet
1/500	5.3 feet	1/100	11.8 feet	1/2	83.3 feet
1/400	5.9 feet	1/50	16.7 feet	1	117.1 feet
1/385	6.0 feet	1/20	26.3 feet		
1/300	6.8 feet	1/10	37.2 feet		

To determine the slope limiting distance, multiply the plot radius for the appropriate plot size by the appropriate slope correction factor.

Slope Correction Table								
Percent of Slope	Degree of Slope	Correction Factor	Percent of Slope	Degree of Slope	Correction Factor	Percent of Slope	Degree of Slope	Correction Factor
0 to 9	0-6	1.00	50 to 51	27	1.12	73 to 74	37	1.24
10 to 17	7-10	1.01	52 to 53	28	1.13	75	37	1.25
18 to 22	11-12	1.02	54 to 55	29	1.14	76 to 77	38	1.26
23 to 26	13-14	1.03	56 to 57	29	1.15	78 to 79	38	1.27
27 to 30	15-17	1.04	58 to 59	30	1.16	80	39	1.28
31 to 33	18	1.05	60 to 61	31	1.17	81 to 82	39	1.29
34 to 36	19-20	1.06	62 to 63	32	1.18	83	40	1.30
37 to 39	21	1.07	64 to 65	33	1.19	84 to 85	40	1.31
40 to 42	22	1.08	66 to 67	34	1.20	86	41	1.32
43 to 44	23	1.09	68 to 69	34	1.21	87 to 88	41	1.33
45 to 47	24	1.10	70	35	1.22	89	42	1.34
48 to 49	25-26	1.11	71 to 72	36	1.23	90 to 91	42	1.35

Appendix J: Variable Radius Plot**Table J-1: BAF 10 Plot Radii**

BAF 10 Plot Radii in Feet and Tenths of Feet from Plot Center to <i>Face of Tree</i> at DBH for 0% Slope										
Inches	0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9
5	13.5	13.8	14.1	14.4	14.6	14.9	15.2	15.4	15.7	16.0
6	16.2	16.5	16.8	17.1	17.3	17.6	17.9	18.1	18.4	18.7
7	19.0	19.2	19.5	19.8	20.0	20.3	20.6	20.9	21.1	21.4
8	21.7	21.9	22.2	22.5	22.7	23.0	23.3	23.6	23.8	24.1
9	24.4	24.6	24.9	25.2	25.5	25.7	26.0	26.3	26.5	26.8
10	27.1	27.4	27.6	27.9	28.2	28.4	28.7	29.0	29.2	29.5
11	29.8	30.1	30.3	30.6	30.9	31.1	31.4	31.7	32.0	32.2
12	32.5	32.8	33.0	33.3	33.6	33.9	34.1	34.4	34.7	34.9
13	35.2	35.5	35.7	36.0	36.3	36.6	36.8	37.1	37.4	37.6
14	37.9	38.2	38.5	38.7	39.0	39.3	39.5	39.8	40.1	40.3
15	40.6	40.9	41.2	41.4	41.7	42.0	42.2	42.5	42.8	43.1
16	43.3	43.6	43.9	44.1	44.4	44.7	45.0	45.2	45.5	45.8
17	46.0	46.3	46.6	46.8	47.1	47.4	47.7	47.9	48.2	48.5
18	48.7	49.0	49.3	49.6	49.8	50.1	50.4	50.6	50.9	51.2
19	51.5	51.7	52.0	52.3	52.5	52.8	53.1	53.3	53.6	53.9
20	54.2	54.4	54.7	55.0	55.2	55.5	55.8	56.1	56.3	56.6
21	56.9	57.1	57.4	57.7	58.0	58.2	58.5	58.8	59.0	59.3
22	59.6	59.8	60.1	60.4	60.7	60.9	61.2	61.5	61.7	62.0
23	62.3	62.6	62.8	63.1	63.4	63.6	63.9	64.2	64.5	64.7
24	65.0	65.3	65.5	65.8	66.1	66.3	66.6	66.9	67.2	67.4
25	67.7	68.0	68.2	68.5	68.8	69.1	69.3	69.6	69.9	70.1
26	70.4	70.7	70.9	71.2	71.5	71.8	72.0	72.3	72.6	72.8
27	73.1	73.4	73.7	73.9	74.2	74.5	74.7	75.0	75.3	75.6
28	75.8	76.1	76.4	76.6	76.9	77.2	77.4	77.7	78.0	78.3
29	78.5	78.8	79.1	79.3	79.6	79.9	80.2	80.4	80.7	81.0
30	81.2	81.5	81.8	82.1	82.3	82.6	82.9	83.1	83.4	83.7
31	83.9	84.2	84.5	84.8	85.0	85.3	85.6	85.8	86.1	86.4
32	86.7	86.9	87.2	87.5	87.7	88.0	88.3	88.6	88.8	89.1
33	89.4	89.6	89.9	90.2	90.4	90.7	91.0	91.3	91.5	91.8
34	92.1	92.3	92.6	92.9	93.2	93.4	93.7	94.0	94.2	94.5
35	94.8	95.1	95.3	95.6	95.9	96.1	96.4	96.7	96.9	97.2
36	97.5	97.8	98.0	98.3	98.6	98.8	99.1	99.4	99.7	99.9
37	100.2	100.5	100.7	101.0	101.3	101.6	101.8	102.1	102.4	102.6
38	102.9	103.2	103.4	103.7	104.0	104.3	104.5	104.8	105.1	105.3
39	105.6	105.9	106.2	106.4	106.7	107.0	107.2	107.5	107.8	108.0
40	108.3	108.6	108.9	109.1	109.4	109.7	109.9	110.2	110.5	110.8
41	111.0	111.3	111.6	111.8	112.1	112.4	112.7	112.9	113.2	113.5
42	113.7	114.0	114.3	114.5	114.8	115.1	115.4	115.6	115.9	116.2
43	116.4	116.7	117.0	117.3	117.5	117.8	118.1	118.3	118.6	118.9
44	119.2	119.4	119.7	120.0	120.2	120.5	120.8	121.0	121.3	121.6
45	121.9	122.1	122.4	122.7	122.9	123.2	123.5	123.8	124.0	124.3
46	124.6	124.8	125.1	125.4	125.7	125.9	126.2	126.5	126.7	127.0
47	127.3	127.5	127.8	128.1	128.4	128.6	128.9	129.2	129.4	129.7
48	130.0	130.3	130.5	130.8	131.1	131.3	131.6	131.9	132.2	132.4
49	132.7	133.0	133.2	133.5	133.8	134.0	134.3	134.6	134.9	135.1
50	135.4	135.7	135.9	136.2	136.5	136.8	137.0	137.3	137.6	137.8

Prepared by multiplying the BAF 10 Plot Radius Factor $2.708 \times \text{DBH}$. For example, if $\text{DBH} = 14.3$ inches, then $14.3 \times 2.708 = 38.8$.

Table J-2: BAF 20 Plot Radii

BAF 20 Plot Radii in Feet and Tenths of Feet from Plot Center to <i>Face of Tree</i> at DBH for 0% Slope										
Inches	0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9
5	9.5	9.7	9.9	10.1	10.3	10.5	10.7	10.8	11.0	11.2
6	11.4	11.6	11.8	12.0	12.2	12.4	12.6	12.8	12.9	13.1
7	13.3	13.5	13.7	13.9	14.1	14.3	14.5	14.7	14.8	15.0
8	15.2	15.4	15.6	15.8	16.0	16.2	16.4	16.6	16.7	16.9
9	17.1	17.3	17.5	17.7	17.9	18.1	18.3	18.5	18.6	18.8
10	19.0	19.2	19.4	19.6	19.8	20.0	20.2	20.4	20.6	20.7
11	20.9	21.1	21.3	21.5	21.7	21.9	22.1	22.3	22.5	22.6
12	22.8	23.0	23.2	23.4	23.6	23.8	24.0	24.2	24.4	24.5
13	24.7	24.9	25.1	25.3	25.5	25.7	25.9	26.1	26.3	26.5
14	26.6	26.8	27.0	27.2	27.4	27.6	27.8	28.0	28.2	28.4
15	28.5	28.7	28.9	29.1	29.3	29.5	29.7	29.9	30.1	30.3
16	30.4	30.6	30.8	31.0	31.2	31.4	31.6	31.8	32.0	32.2
17	32.4	32.5	32.7	32.9	33.1	33.3	33.5	33.7	33.9	34.1
18	34.3	34.4	34.6	34.8	35.0	35.2	35.4	35.6	35.8	36.0
19	36.2	36.3	36.5	36.7	36.9	37.1	37.3	37.5	37.7	37.9
20	38.1	38.3	38.4	38.6	38.8	39.0	39.2	39.4	39.6	39.8
21	40.0	40.2	40.3	40.5	40.7	40.9	41.1	41.3	41.5	41.7
22	41.9	42.1	42.2	42.4	42.6	42.8	43.0	43.2	43.4	43.6
23	43.8	44.0	44.1	44.3	44.5	44.7	44.9	45.1	45.3	45.5
24	45.7	45.9	46.1	46.2	46.4	46.6	46.8	47.0	47.2	47.4
25	47.6	47.8	48.0	48.1	48.3	48.5	48.7	48.9	49.1	49.3
26	49.5	49.7	49.9	50.0	50.2	50.4	50.6	50.8	51.0	51.2
27	51.4	51.6	51.8	52.0	52.1	52.3	52.5	52.7	52.9	53.1
28	53.3	53.5	53.7	53.9	54.0	54.2	54.4	54.6	54.8	55.0
29	55.2	55.4	55.6	55.8	55.9	56.1	56.3	56.5	56.7	56.9
30	57.1	57.3	57.5	57.7	57.9	58.0	58.2	58.4	58.6	58.8
31	59.0	59.2	59.4	59.6	59.8	59.9	60.1	60.3	60.5	60.7
32	60.9	61.1	61.3	61.5	61.7	61.8	62.0	62.2	62.4	62.6
33	62.8	63.0	63.2	63.4	63.6	63.8	63.9	64.1	64.3	64.5
34	64.7	64.9	65.1	65.3	65.5	65.7	65.8	66.0	66.2	66.4
35	66.6	66.8	67.0	67.2	67.4	67.6	67.7	67.9	68.1	68.3
36	68.5	68.7	68.9	69.1	69.3	69.5	69.6	69.8	70.0	70.2
37	70.4	70.6	70.8	71.0	71.2	71.4	71.6	71.7	71.9	72.1
38	72.3	72.5	72.7	72.9	73.1	73.3	73.5	73.6	73.8	74.0
39	74.2	74.4	74.6	74.8	75.0	75.2	75.4	75.5	75.7	75.9
40	76.1	76.3	76.5	76.7	76.9	77.1	77.3	77.5	77.6	77.8
41	78.0	78.2	78.4	78.6	78.8	79.0	79.2	79.4	79.5	79.7
42	79.9	80.1	80.3	80.5	80.7	80.9	81.1	81.3	81.4	81.6
43	81.8	82.0	82.2	82.4	82.6	82.8	83.0	83.2	83.4	83.5
44	83.7	83.9	84.1	84.3	84.5	84.7	84.9	85.1	85.3	85.4
45	85.6	85.8	86.0	86.2	86.4	86.6	86.8	87.0	87.2	87.3
46	87.5	87.7	87.9	88.1	88.3	88.5	88.7	88.9	89.1	89.3
47	89.4	89.6	89.8	90.0	90.2	90.4	90.6	90.8	91.0	91.2
48	91.3	91.5	91.7	91.9	92.1	92.3	92.5	92.7	92.9	93.1
49	93.2	93.4	93.6	93.8	94.0	94.2	94.4	94.6	94.8	95.0
50	95.2	95.3	95.5	95.7	95.9	96.1	96.3	96.5	96.7	96.9

Prepared by multiplying the BAF 20 Plot Radius Factor 1.902 * DBH. For example, if DBH = 14.3 inches, then 14.3 * 1.903 = 27.

Table J-3: Limiting Distance to Face of Tree for Various Basal Area Factors

This table provides an expanded list of slope correction factors to the face of the tree for use with various basal area factors. To use the table, measure the slope and the distance from plot center to the face of the tree at DBH. To obtain the corrected limiting distance to a tree multiply the trees DBH by the "slope correction factor" shown under the appropriate BAF heading.

Slope %	Slope Correction Factor	10 BAF	20 BAF	Slope %	Slope Correction Factor	10 BAF	20 BAF
1	1.00000	2.708	1.902	46	1.10073	2.981	2.094
2	1.00020	2.709	1.902	47	1.10494	2.992	1.473
3	1.00045	2.709	1.903	48	1.10923	3.004	1.479
4	1.00080	2.710	1.904	49	1.11360	3.016	1.484
5	1.00125	2.711	1.904	50	1.11803	3.028	1.490
6	1.00180	2.713	1.905	51	1.12254	3.040	1.496
7	1.00245	2.715	1.907	52	1.12712	3.052	1.502
8	1.00319	2.717	1.908	53	1.13177	3.065	1.509
9	1.00404	2.719	1.910	54	1.13649	3.078	1.515
10	1.00499	2.722	1.911	55	1.14127	3.091	1.521
11	1.00603	2.724	1.912	56	1.14612	3.104	1.528
12	1.00717	2.727	1.916	57	1.15104	3.117	1.534
13	1.00841	2.731	1.918	58	1.15603	3.131	1.541
14	1.00975	2.734	1.921	59	1.16108	3.144	1.548
15	1.01119	2.738	1.923	60	1.16619	3.158	1.555
16	1.01272	2.742	1.926	61	1.17137	3.172	1.561
17	1.01435	2.747	1.921	62	1.17661	3.186	1.568
18	1.01607	2.752	1.933	63	1.18191	3.201	1.575
19	1.01789	2.756	1.936	64	1.18727	3.215	1.583
20	1.01980	2.762	1.940	65	1.19269	3.230	1.590
21	1.02181	2.767	1.943	66	1.19817	3.245	1.597
22	1.02391	2.773	1.947	67	1.20370	3.260	1.605
23	1.02611	2.779	1.952	68	1.20930	3.275	1.612
24	1.02840	2.785	1.956	69	1.21499	3.302	1.626
25	1.03078	2.791	1.967	70	1.22066	3.306	1.627
26	1.03325	2.798	1.965	71	1.22642	3.321	1.635
27	1.03581	2.805	1.970	72	1.23223	3.337	1.643
28	1.03846	2.812	1.975	73	1.23810	3.353	1.650
29	1.04120	2.820	1.980	74	1.24403	3.369	1.658
30	1.04403	2.827	1.986	75	1.25000	3.385	1.666
31	1.04695	2.835	1.991	76	1.25603	3.401	1.674
32	1.04995	2.843	1.997	77	1.26210	3.418	1.682
33	1.05304	2.852	2.003	78	1.26823	3.434	1.691
34	1.05622	2.960	2.009	79	1.27440	3.451	1.699
35	1.05948	2.869	2.015	80	1.28062	3.468	1.707
36	1.06283	2.878	2.022	81	1.28690	3.485	1.715
37	1.06626	2.887	2.028	82	1.29321	3.502	1.724
38	1.06977	2.897	2.035	83	1.29958	3.519	1.732
39	1.07336	2.907	2.042	84	1.30599	3.537	1.741
40	1.07703	2.917	2.049	85	1.31244	3.554	1.749
41	1.08079	2.927	2.056	86	1.31894	3.572	1.758
42	1.08462	2.937	2.063	87	1.32548	3.589	1.767
43	1.08853	2.948	2.070	88	1.33207	3.607	1.776
44	1.09252	2.959	2.078	89	1.33870	3.625	1.784
45	1.09659	2.970	2.086	90	1.34536	3.643	1.793

Appendix K: Damage Categories, Agents, Severity Ratings, and Tree Parts

Damage Categories

Code	Description
10	General insects
11	Bark beetles
12	Defoliators
13	Chewing insects
14	Sucking insects
15	Boring insects
16	Seed/cone/flower/fruit insects
17	Gallmaker insects
18	Insect predators
19	General diseases
20	Biotic damage
21	Root/butt diseases
22	Stem decays/cankers
23	Parasitic/epiphytic plants
24	Decline complexes/dieback/wilts
25	Foliage diseases
26	Stem rusts
27	Broom rusts
30	Fire
41	Wild animals
42	Domestic animals
50	Abiotic damage
60	Competition
70	Human activities
71	Harvest
80	Multi-damage (insect/disease)
90	Unknown
99	Physical effects

Damage Agents

Category	Agent	Common Name
10	000	General Insects
<u>SEVERITY RATING</u> 1 = minor 2 = severe		
	002	Tip moth
	008	Weevil
	010	Allegheny mound ant
	023	Wood wasps
11	000	Bark Beetles
<u>SEVERITY RATING</u> 1 = Unsuccessful bole attack: pitchout and beetle brood present 2 = Strip attacks: galleries and brood present 3 = Successful current bole attack: galleries and brood present 4 = Topkill 5 = Successful attack last year 6 = Older dead		
	008	Allegheny spruce beetle
	010	Eastern larch beetle
	012	Red turpentine beetle
	017	Ash bark beetles
	018	Native elm bark beetle
	029	Pine engraver
	030	Ips engraver beetles
	037	Tip beetles
	039	Twig beetles
	045	Small European elm bark beetle
	047	Hickory bark beetle
	051	Striped ambrosia beetle
	053	Four-eyed bark beetle
12	000	Defoliators
<u>SEVERITY RATING</u> 1 = Light defoliation (1-25%), no topkill 2 = Light defoliation (1-25%), topkill ≤10% 3 = Light defoliation (1-25%), topkill >10% 4 = Moderate defoliation (26-75%), no topkill 5 = Moderate defoliation (26-75%), topkill ≤10% 6 = Moderate defoliation (26-75%), topkill >10% 7 = Heavy defoliation (76-100%), no topkill 8 = Heavy defoliation (76-100%), topkill ≤10% 9 = Heavy defoliation (76-100%), topkill >10%		
	001	Casebearer
	002	Leaf-tier
	003	Looper
	004	Needleminer
	005	Sawfly
	006	Skeletonizer
	008	Spanworm
	009	Webworm
	012	Eastern blackheaded budworm
	014	Fall cankerworm
	017	Birch leafroller
	018	Oak worms
	019	Orange-striped oakworm
	021	Fruit tree leafroller
	024	Oak leafroller

Category	Agent	Common Name
	025	Birch sawfly
	029	Oak skeletonizer
	031	Scarlet oak sawfly
	034	Maple petiole borer
	036	Two-year budworm
	037	Large aspen tortrix
	041	Jack pine budworm
	043	Aspen leaf beetle
	045	Leafhopper
	047	Larch casebearer
	048	Birch casebearer
	053	Sycamore lace bug
	054	Lace bugs
	055	Oak leaf-tier
	062	Greenstriped mapleworm
	064	Elm spanworm
	065	Maple trumpet skeletonizer
	067	Linden looper
	069	Pine needleminer
	070	Birch leafminer
	072	Geometrid moth
	073	Leafblotch miner
	074	Spotted tussock moth
	075	Pale tussock moth
	079	Saddled prominent
	080	Variable oakleaf caterpillar
	081	Cherry scallop shell moth
	082	Fall webworm
	083	Hemlock looper
	085	Tent caterpillar moth
	088	Aspen blotchminer
	089	Gypsy moth
	091	Dogwood sawfly
	093	Eastern tent caterpillar
	096	Forest tent caterpillar
	106	Pine infesting sawflies
	110	White pine sawfly
	115	Hemlock sawfly
	117	False hemlock looper
	120	Bruce spanworm
	122	Whitemarked tussock moth
	125	Spring cankerworm
	127	Maple leafcutter
	130	Half-wing geometer
	131	Phoberia moth
	135	Aspen leafminer
	139	Larch sawfly
	144	Redhumped caterpillar
	145	Redbanded thrips
	146	Larch looper
	147	Maple leafroller
	148	Redhumped oakworm
	149	Orangehumped mapleworm
	151	Maple webworm
	152	Pine webworm
	153	Imported basswood thrips

Category	Agent	Common Name
	154	<i>Thyridopteryx ephemeraeformis</i>
	155	Leafroller/seed moth
	159	Larch bud moth
	165	Leaf roller
	174	Pine looper
13	000	Chewing Insects
SEVERITY RATING		
1 = minor		
2 = severe		
	011	Vegetable weevil
	020	Northern pitch twig moth
	022	Pine needle weevil
	025	Unknown
	028	Pitch-eating weevil
14	000	Sucking Insects
SEVERITY RATING		
1 = minor		
2 = severe		
	001	Scale insect
	003	Balsam woolly adelgid
	004	Hemlock woolly adelgid
	005	Spiraling whitefly
	006	Aphid
	010	Spittlebug
	012	Pine needle scale
	015	White pine aphid
	016	Beech scale
	020	Elongate hemlock scale
	022	Pine thrips
	028	Oystershell scale
	033	Red pine scale
	035	Treehoppers
	037	Balsam twig aphid
	041	Twig girdler
	042	Woolly alder aphid
	043	Maple aphids
	045	Red pine adelgid
	046	Pine leaf adelgid
	047	White pine adelgid
	048	Pine bark adelgid
	049	Root aphid
	050	Mealybug
	051	Cottony maple scale
	056	Woolly pine needle aphid
	058	Pear thrips
	060	Tuliptree scale
	063	Birch aphid
	070	Magnolia scale
	071	Beech blight aphid
14	000	Sucking Insects
	072	Beech wooly aphid
15	000	Boring Insects
SEVERITY RATING		
1 = minor		
2 = severe		
	001	Shoot borer

Category	Agent	Common Name
	002	Termite
	004	Bronze birch borer
	005	Twolined chestnut borers
	008	Flatheaded borer
	010	Carpenter ants
	013	Roundheaded borer
	018	Carpenterworm moths
	020	Pine reproduction weevil
	023	Oak twig pruners
	024	Twig pruner
	026	Red oak borer
	028	Eastern pine shoot borer
	030	Eucosma species
	031	Sugar maple borer
	033	Pine root collar weevil
	038	White pine bark miner
	039	Locust borer
	042	Whitespotted sawyer
	043	Redheaded ash borer
	047	Northern pine weevil
	050	White pine weevil
	052	Ambrosia beetles
	055	Pine gall weevil
	056	Ash borer
	059	Maple shoot borers
	063	European pine shoot moth
	065	Nantucket pine tip moth
	071	Clearwing moths
	072	Dogwood borer
	087	Hemlock borer
16	000	Seed/Cone/Flower/Fruit Insects
<u>SEVERITY RATING</u>		
1 = minor		
2 = severe		
	007	Red pine cone beetle
	008	White pine cone beetle
	011	Cone scale midge
	017	Pine coneworm
	021	Dioryctria moths
	029	Boxelder bug
	038	Yellow poplar weevil
	042	Coneworm
	048	Coneworm
17	000	Gallmaker Insects
<u>SEVERITY RATING</u>		
1 = minor		
2 = severe		
	001	Birch budgall mite
	002	Eastern spruce gall adelgid
	003	Cooley spruce gall adelgid
	004	Horned oak gall
	005	Gouty oak gall
	006	Gall midge
	008	Gall mite
	012	Leaf stem gall adelgid
	013	Gall aphid

Category	Agent	Common Name
	015	Psyllid
	018	Gouty pitch midge
18	000	Insect Predators
<u>SEVERITY RATING</u> 1 = minor 2 = severe		
19	000	General Diseases
<u>SEVERITY RATING</u> 1 = minor 2 = severe		
20	000	Biotic Damage
<u>SEVERITY RATING</u> 1 = minor 2 = severe		
	001	Damping off
	002	Gray mold
21	000	Root/Butt Diseases
<u>SEVERITY RATING</u> 1 = Tree within 30 feet of tree with deteriorating crown, tree with diagnostic symptoms or signs, or tree killed by root disease 2 = Pathogen (sign) or diagnostic symptom detected - no crown deterioration 3 = Crown deterioration detected - no diagnostic symptoms or signs 4 = Both crown deterioration and diagnostic signs symptoms detected 5 = Bleeding present on bole 6 = Bleeding present on bole and adjacent mortality present 7 = Laboratory confirmed Sudden Oak Death		
	001	Armillaria root disease
	002	Yellow stringy rot
	004	Brown crumbly rot
	005	Black root rot of pine
	006	Fusarium root rot
	007	White mottled rot
	008	Ganoderma rot of hardwoods
	009	Ganoderma rot of conifers
	010	Annosus root disease
	011	Circinatus root rot
	012	Tomentosus root disease
	013	Charcoal root rot
	014	Black stain root disease
	018	Phytophthora root rot
	024	Crown gall
	025	Borealis conk
	026	Yellow pitted rot
	027	Brown cubical rot
22	000	Stem Decays/Cankers
<u>SEVERITY RATING</u> 0 = 0-4% rotten 11 = Branch infections present, <50% of the crown affected 1 = 5-15% rotten 12 = Branch infections present ≥50% of the crown affected, or any infection on the bole 2 = 16-25% rotten 13 = No bole canker and <10 infected branch tips 3 = 26-35% rotten 14 = No bole canker and ≥10 infected branch tips 4 = 36-45% rotten 15 = One or more bole cankers, and <10 infected branch tips 5 = 46-55% rotten 16 = One or more bole cankers, and ≥10 infected branch tips 6 = 56-65% rotten 17 = One conk on the stem or present at ground level 7 = 66-75% rotten 18 = Two or more conks separated by <16 feet on the bole 8 = 76-85% rotten 19 = Two or more conks separated by ≥16 feet on the bole		

Category	Agent	Common Name
9 = 86-100% rotten 20 = No conks, visible decay in the interior of the bole		
	001	Heart rot
	002	Stem rot
	003	Sap rot
	004	Slime flux
	005	Virus
	006	Black knot of cherry
	007	Atropellis canker
	010	Black rot fungus
	013	Sycamore canker stain
	023	Chestnut blight
	028	Rust-red stringy rot
	029	Sooty-bark canker
	032	Pitch canker
	037	Hypoxylon canker of oak
	038	Hypoxylon canker of aspen
	039	Canker rot of oak
	040	Sterile conk trunk rot of birch
	042	Beech bark disease
	043	Nectria canker
	044	Ash heart rot
	048	Aspen trunk rot
	053	Butternut canker
	054	Maple canker
	061	Sooty bark canker
	062	Brown heartrot
	069	Robustus conk
	070	Yellow cap fungus
	071	Oyster mushroom
	072	White ring rot
	073	Hemlock canker
23	000	Parasitic/Epiphytic Plants
SEVERITY RATING		
1 = Hawksworth tree DMR rating 1		
2 = Hawksworth tree DMR rating 2		
3 = Hawksworth tree DMR rating 3		
4 = Hawksworth tree DMR rating 4		
5 = Hawksworth tree DMR rating 5		
6 = Hawksworth tree DMR rating 6		
7 = Vine damage: less than 50% of crown involved		
8 = Vine damage: 50% or more of crown involved		
	002	Parasitic plants
	003	Vine damage
	015	Eastern dwarf mistletoe
	016	Hemlock dwarf mistletoe
24	000	Decline Complexes/Dieback/Wilts
SEVERITY RATING		
1 = minor		
2 = severe		
	004	Ash decline/yellows
	005	Birch dieback
	007	Complex
	008	Decline
	009	Fall hardwood defoliator complex
	011	Larch decline
	012	Looper; abiotic complex

Category	Agent	Common Name
	013	Maple decline
	014	Oak decline
	016	Sprout dieback
	020	Sapstreak disease of sugar maple
	021	Oak wilt
	028	Hemlock decline
25	000	Foliage Diseases
SEVERITY RATING		
1 = minor		
2 = severe		
	001	Blight
	002	Broom rust
	004	Leaf spots
	005	Needlecast
	006	Powdery mildew
	010	Sycamore anthracnose
	011	Cercospora blight of juniper
	014	Ink spot of aspen
	015	Pine needle rust
	016	Anthrachnose on Russian olive
	018	Leaf shothole
	020	Dogwood anthracnose
	025	Anthrachnose
	028	Larch needle blight
	029	Hardwood anthracnose
	030	Cone damage
	031	Spruce needle cast
	033	White pine needle cast
	039	Larch needle cast
	041	Brown felt blight of pines
	046	Bud rot
	048	Ash rust
	054	Brown spot needle blight
	059	Leaf blister of oak
	064	Broom rust
	067	Spruce needle cast
	068	Hardwood leaf rusts
	070	Hemlock needle rust
	071	Spruce needle cast
26	000	Stem Rusts
SEVERITY RATING		
1 = Branch infections located greater than 2 feet from tree bole		
2 = Branch infections located between 6 inches and 2 feet from tree bole		
3 = Bole infections or branch infections located within 6 inches of bole		
4 = Topkill		
	006	Eastern gall rust
	009	Fusiform rust
	012	Limb rust
27	000	Broom Rusts
SEVERITY RATING		
1 = minor		
2 = severe		

Category	Agent	Common Name
30	000	Fire
<u>SEVERITY RATING</u> 1 = minor 2 = severe		
	031	Wildfire
	032	Human caused fire
40	000	Animal damage, source unknown
<u>SEVERITY RATING</u> 1 = minor 2 = severe		
41	000	Wild Animals
<u>SEVERITY RATING</u> 1 = minor 2 = severe		
	002	Beaver
	004	Mice or voles
	005	Pocket gophers
	006	Porcupines
	007	Rabbits or hares
	008	Sapsucker
	010	Woodpeckers
	013	Deer
42	000	Domestic Animals
<u>SEVERITY RATING</u> 1 = minor 2 = severe		
50	000	Abiotic Damage
<u>SEVERITY RATING</u> 1 = minor 2 = severe		
	001	Air pollutants
	002	Chemical
	003	Drought
	004	Flooding/high water
	005	Frost
	006	Hail
	007	Heat
	008	Lightning
	009	Nutrient imbalances
	011	Snow/ice
	013	Wind/tornado
	014	Winter injury
60	000	Competition
<u>SEVERITY RATING</u> 1 = minor 2 = severe		
70	000	Human Activities
<u>SEVERITY RATING</u> 1 = minor 2 = severe		
	001	Herbicides
	003	Imbedded objects
	004	Improper planting technique
	005	Land clearing
	006	Land use conversion
	007	Logging damage

Category	Agent	Common Name
	008	Mechanical
	009	Pesticides
	010	Roads
	011	Soil compaction
	012	Suppression
	013	Vehicle damage
	014	Road salt
71	000	Harvest
<u>SEVERITY RATING</u> 1 = minor 2 = severe		
80	000	Multi-Damage (Insect/Disease)
<u>SEVERITY RATING</u> 1 = minor 2 = severe		
90	000	Unknown
<u>SEVERITY RATING</u> 0 = 0 – 9% affected 1 = 10 – 19% affected 2 = 20 – 29% affected 3 = 30 – 39% affected 4 = 40 - 49% affected 5 = 50 - 59% affected 6 = 60 - 69% affected 7 = 70 - 79% affected 8 = 80 - 89% affected 9 = 90 - 100% affected		
99	000	Physical Effects
		How to Code Severity (actual %)
	000	Unknown
	001	Broken or missing top
	002	Dead top
	003	Limby (large limbs top to bottom)
	004	Forked top
	005	Forked below merch top
	006	Crook or sweep
	007	Checks, bole cracks
	008	Foliage discoloration
	009	Mortality
	010	Lack of seed source
	011	Poor planting stock
	012	Poor growth
	013	Total board foot volume loss
	014	Total cubic foot volume loss
	015	Bark removal
	016	Foliage loss
	017	Sunscald
	018	Uproot
	019	Scorched foliage
	020	Scorched bark
	021	Dieback
	022	Poor crown form
	023	Severe forking
	024	Canker or gall
	025	Conk, fruiting body or sign of advanced decay
	026	Open wound
	027	Resinosis or gumosis
	028	Broom on root or bole
	029	Broken or dead root farther than 3 feet from bole
	030	Vines in the crown

Category	Agent	Common Name
	031	Broken or dead branches
	032	Excessive branching or brooms within the live crown
	033	Damaged shoots, buds, or foliage
	034	Excessively deformed sapling
	035	Broken bole or broken root within 3 feet of bole
	036	Fire scar

Tree Parts

Code	Description	Code	Description
UN	Unspecified	WT	Whole Tree
TO	Top	TT	Top Third of Crown
FO	Foliar (crown)	MT	Middle Third of Crown
LI	Limb	BT	Bottom Third of Crown
BO	Bole, other than Top or Base	TA	Above merch top
UB	Upper bole (upper half of bole between stump and base of live crown)	TB	Below merch top
LB	Lower bole (lower half of bole between stump and base of live crown)	RS	Roots (exposed) and stump (up to 12 inches from ground level)
LU	Lower and upper bole	RL	Roots, stumps, and lower bole
BA	Base	CS	Crown stem (main stem within the live crown)
RO	Roots	BS	Buds and shoots of current year

Appendix L: Measuring DBH & DRC

DBH

DBH is outside bark diameter at 4.5 feet above the forest floor on the uphill side of the tree. To determine breast height, the forest floor includes the duff layer that may be present, but does not include unincorporated woody debris that may rise above the ground line. If a dead tree (snag) is missing bark, measure the DBH without the bark and record that measurement.

Forked tree: In order to qualify as a fork, the stem in question must be at least 1/3 the diameter of the main stem and must branch out from the main stem at an angle of 45 degrees or less. Forks originate at the point on the bole where the piths intersect. Forked trees are handled differently depending on whether the fork originates above or below 4.5 feet.

Trees forked below 4.5 feet are treated as distinctly separate trees. DBH is measured for each stem at 4.5 ft above the ground.

Trees forked at or above 4.5 feet count as one tree. If a fork occurs at or immediately above 4.5 ft, measure diameter below the fork just beneath any swelling that would inflate DBH.

Stump sprouts originate between ground level and 4.5 ft on the boles of trees that have died or been cut. Stump sprouts are handled the same as forked trees, with the exception that stump sprouts are not required to be 1/3 the diameter of the dead bole. Stump sprouts originating below 1.0 ft are measured at 4.5 ft from ground line. For multi-stemmed woodland species, treat all new sprouts as part of the same new tree.

Tree with irregularities at DBH: On trees with swellings, bumps, depressions, and branches at DBH, diameter will be measured immediately above the irregularity at the place it ceases to affect normal stem form. If this is not possible, because of the vertical extent of the irregularity, then adjust the DBH measurement to better reflect the diameter of a regular bole.

Tree on slope: Measure diameter at 4.5 ft from the ground along the bole on the uphill side of the tree.

Leaning tree: Measure diameter at 4.5 ft from the ground along the bole.

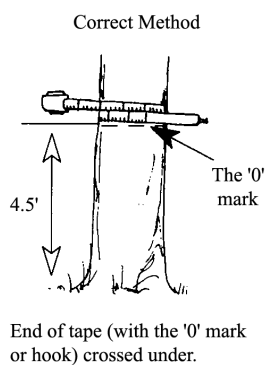
Turpentine tree: On trees with turpentine face extending above 4.5 ft, estimate the diameter at 10.0 ft above the ground and multiply by 1.1 to estimate DBH outside bark.

Independent trees that grow together: If two or more independent stems have grown together at or above the point of DBH, continue to treat them as separate trees.

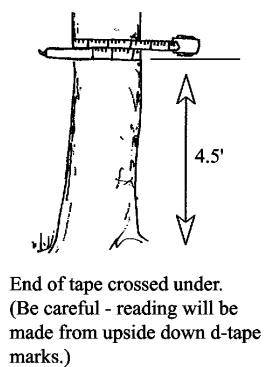
Missing wood or bark: If 50% or more of the circumference of the bole is intact, reconstruct the diameter at DBH.

Diameter on stump: Use a logger's tape, cloth tape, or ruler to measure the longest and shortest axis across the top of the stump. Record the diameter as the average of the two measurements.

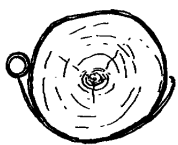
Proper Use of a Diameter Tape



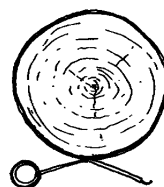
Optional method if left handed



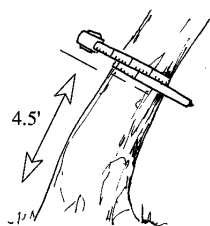
Press the tape firmly against the tree. Do not pull it out at a tangent to the tree at the point of measurement.



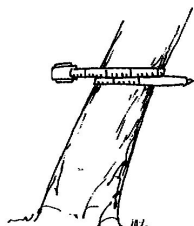
Correct



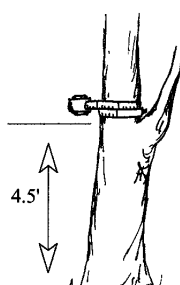
Incorrect



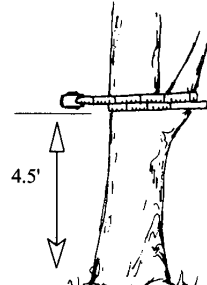
Correct



Incorrect



Correct

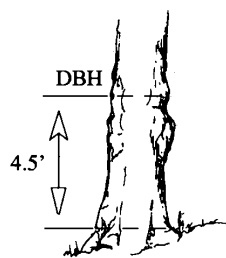


Incorrect

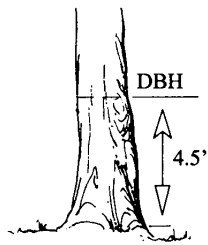
Tape must be at right angles to lean of tree.

Do not place tape at abnormal location on bole of tree.

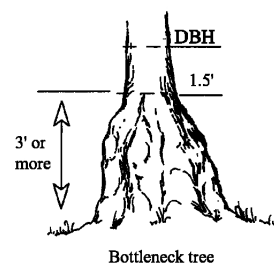
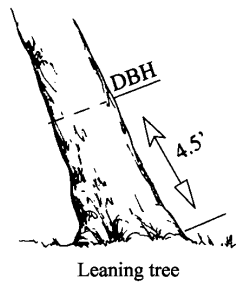
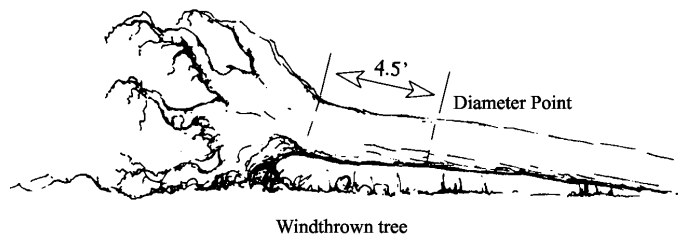
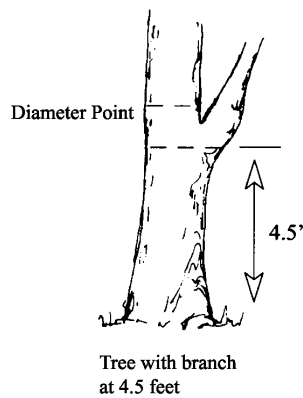
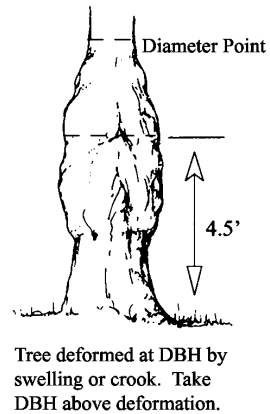
Point of Measurement for DBH

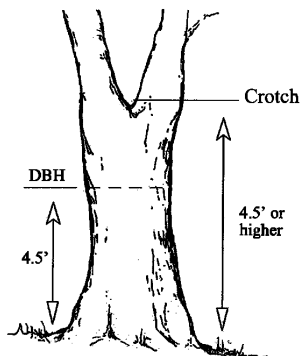
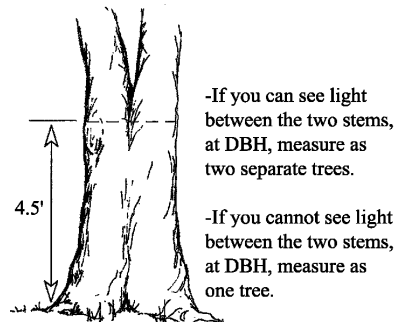
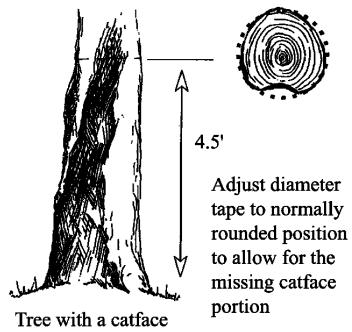


Tree on slope

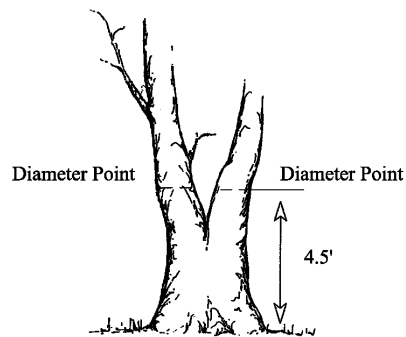


Tree on level ground

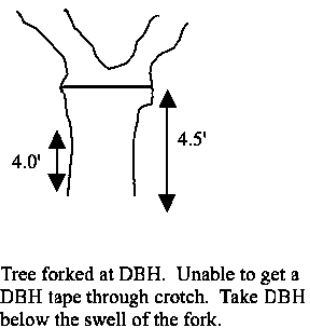
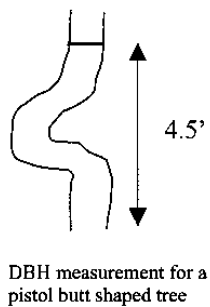
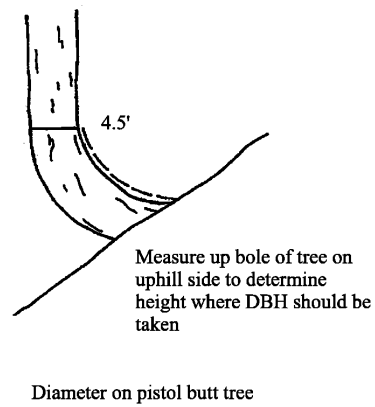
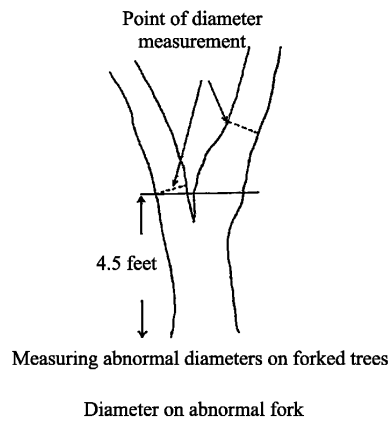


Point of Measurement for DBH (cont.)

Tree forked at 4.5 feet or higher. Record as one tree and consider only the main fork. Take DBH below the swell of the fork.



Tree forked below 4.5 feet. Record each fork that is "in" as a separate tree. Measure diameter at 4.5 feet.

Point of Measurement for DBH (cont.)

DRC

Diameter at Root Collar (DRC) is the diameter measured at the root collar or at the natural ground line, whichever is higher, outside the bark. Measure tree stems only, not branches. A stem generally grows in an upright position and contributes to the main structural support of a tree crown. If the diameter is measured at root collar, the number of stems is required.

DRC measured trees commonly have multiple stems. DRC-measured trees with stems clumped together and a unified crown and appearing to be from the same origin are treated as one tree. If necessary for diameter measurement, remove loose material on the ground but not mineral soil. For multi-stemmed DRC-measured trees with at least one stem ≥ 5.0 " at the root collar, DRC is computed as the square root of the sum of the squared stem diameters. For a single-stemmed tree, DRC is equal to the single diameter measured. For a multi-stemmed tree, DRC is calculated from the diameter measurements of all qualifying stems (≥ 1.5 " diameter and at least one foot in length).

Use the following formula to compute DRC. Record individual stem diameters in the tree form "REMARKS" column for future reference.

$$DRC = \sqrt{n \sum_{i=1}^n (\text{stem diameter})^2}$$

Example: Tree #1 has three qualifying stems; 5.9, 2.4, and 1.5

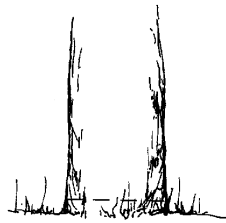
$$DRC = \sqrt{(5.9)^2 + (2.4)^2 + (1.5)^2} = 6.5$$

When DRC is impossible or extremely difficult to measure with a diameter tape (e.g., due to thorns, extreme limbs, packrat's nest), the stem(s) may be estimated to the nearest inch. Note "estimated DRC" in the tree form "REMARKS" column.

Accuracy Standards:

<.5 inch	No Errors
.5 inch - 13.9 inches	± 0.1 inch
14.0 inches - 23.9 inches	± 0.2 inch
24.0 inches - 34.9 inches	± 0.3 inch
35.0 + inches	± 0.5 inch
Borderline variable plot trees	± 1 inch (for the purpose of determining trees in or out)
Estimated DRC	± 1 inch

Point of Measurement for DRC



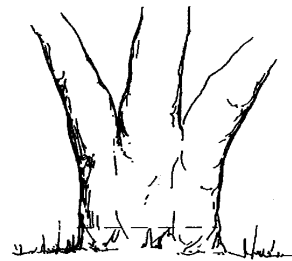
Measure at ground
line when reasonable



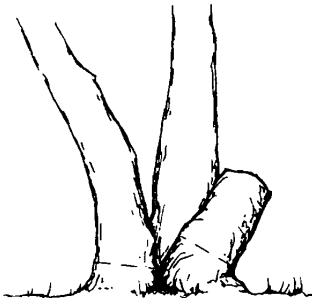
Measure above butt swell



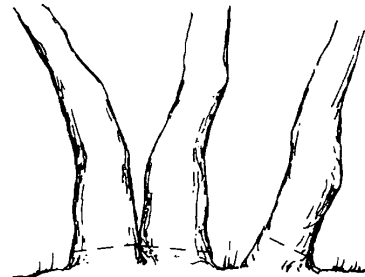
Excessive diameter below stems.
Measure each stem and compute DRC



Multistemmed above diameter



Measure missing stem(s) and
compute DRC



Multistemmed at or below ground.
Measure each stem and compute DRC.

Appendix M: Measuring Heights

Height (maximum of 3 numbers)

Record tree height, in feet, from ground line on the uphill side to the uppermost tip. If the top is broken or missing, record the height to the break, and record the appropriate physical damage code. Tree heights are required for:

- Site Trees
- Growth Sample Trees
- Trees less than 4.5 feet tall. Does not apply to DRC species.
- All trees with broken or missing tops
- Dead trees (snags)

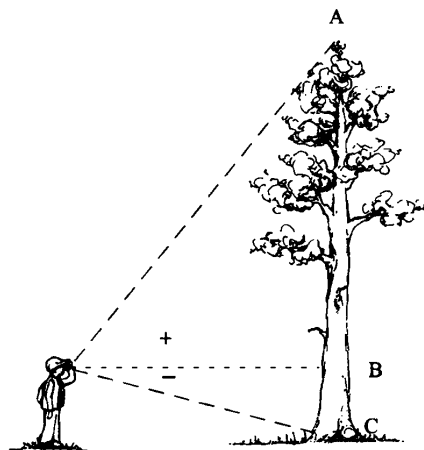
Additional tree heights should be measured and recorded when two adjacent sample trees of similar height can be viewed from the same vantage point, and when the height/diameter relationship of a particular tree seems atypical with respect to other trees of the same species.
Accuracy Standard: $\pm 10\%$

Examples:

1	0.1 - 1.4 feet tall
23	22.5 - 23.4 feet tall
151	150.5 - 151.4 feet tall

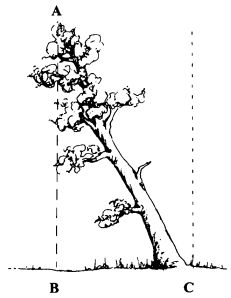
Total Tree Height

Measure from the base of the tree on the high ground side to the tip of the tree leader. Measure height from a point uphill or on the same contour line as the tree. Record total tree height to the nearest foot.



Leaning Trees

Trees leaning 25% (about 15°) or more from vertical require the following special height measuring technique.



Locate point on ground directly under tip of leaning tree. Measure height A B. Measure horizontal distance B C. Determine actual tree height (AC) using either the Pythagorean theory for right triangles where:

$$\text{Tree Height} = \sqrt{AB^2 + BC^2}$$

Example: Measured height (AB) = 120'
Horizontal distance (BC) = 40'

$$\text{Corrected tree height} = \sqrt{120^2 + 40^2} = 126.49$$

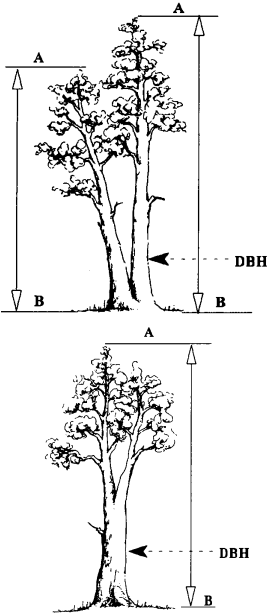
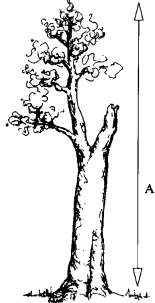

Or, use the following table:

Horizontal Distance - tip to center of bole at ground (B C)

MS HT	5	10	15	20	25	30	35	40	45	50	55	60	65	70	75	80	85	90
40	40	41	43	45														
50	50	51	52	54	56													
60	60	61	62	63	65	67												
70		71	72	73	74	76	78											
80		81	81	82	84	86	87	89										
90		91	91	92	94	95	97	98	101									
100		101	101	102	103	104	106	108	110	112								
110			111	112	113	114	116	117	119	121	123							
120			121	122	123	124	125	126	128	130	132	134						
130			131	131	132	133	135	136	138	139	141	143	145					
140			141	141	142	143	144	146	147	149	150	152	154	157				
150			151	151	152	153	154	155	157	158	160	162	164	166	168			
160			161	161	162	163	164	165	166	168	169	171	173	175	177	179		
170			171	171	172	173	174	175	176	177	179	180	182	184	186	188	190	
180			181	181	182	183	183	184	176	187	188	190	191	193	195	197	199	201
190				191	192	192	193	194	195	196	198	200	201	203	204	206	208	210
200				201	202	202	203	204	205	206	208	209	211	212	214	215	217	219

MS HT = (A B) Measured Height

Forked Trees

<p>If tree forks below DBH, treat as two trees and measure height of each stem from base of tree to tip of tree.</p> <p>If the fork crotch occurs at or above 4.5 feet on high ground side, the tree is treated as a single tree. Measure height of the tallest fork.</p>	
<p>Forked Tree with a Broken Top The height of the tallest fork is measured and recorded in the "Total Height" field. Record a tree damage of "broken top."</p>	
<p>Trees with a Missing Top Measure height of stub and record in the "Total Height" field. Record a tree damage of "missing top." If the tree is forked, measure the height of the stub of the dominant fork.</p>	

Appendix N: Measuring Age

Tree Age (maximum of 4 numbers)

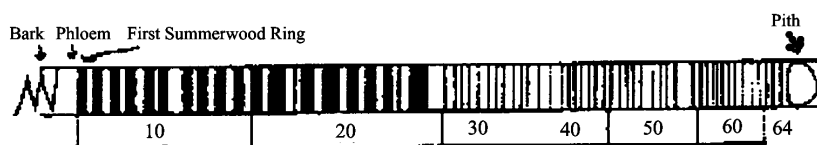
Record the tree age in years. This is required for Growth Sample trees and Site Index trees.

Total Age for Trees Less Than 3.0 Inches DBH

Total age is determined by counting branch whorls that represent annual height increments, or by severing the tree at the root collar and counting annual rings on the stump, or by taking an increment boring at the root collar. The most efficient and accurate method to use depends largely on the species and size of the sample tree.

DBH Age for Trees 3 Inches DBH and Larger

For trees 3.0 inches DBH and larger, age is determined from an increment boring made at breast height. To reduce bias, the increment boring should be made at breast height facing plot center. Usually the boring for measuring radial growth is also used for age measurement. Age is counted from the most current summerwood ring to the pith of the tree. (If age cannot be determined because of extensive heartrot, and this is a site tree, select another tree.) Record the age counted, do not add an estimate of the number of years to grow to breast height.



The ring count is 64 years, so record "64" for the tree age.

Age Measurements for Large Trees: When determining the age of a tree that has a radius greater than the length of the increment borer, bore into the tree as far as possible, extract core and count the rings. Measure the diameter of the tree and divide by two, then subtract the bark thickness. This gives the radius of the wood part of the tree. Measure the length of the core and subtract from the radius of the wood to determine how much longer the core would have to be to reach the pith. Count the number of rings in the innermost inch and extrapolate to the center.

Example: Determine the age of a 40-inch DBH tree having a bark thickness of 2.0 inches when a core 16 inches long has 200 rings and the innermost inch has 5 rings.

- | | | |
|--------------------------------------|----------------------------------|----------|
| 1. DBH / 2 | $40.0 / 2 = 20.0$ | |
| 2. Bark thickness | 2 inches | |
| 3. Difference | $20.0 - 2 = 18$ (radius of wood) | |
| 4. Core length | 16 inches | |
| 5. Radius of wood - core length | $18 - 16 = 2$ | |
| 6. Number of rings (inner-most inch) | 5 | |
| 7. Product (of #5 and #6 above) | $2 \times 5 = 10$ | |
| 8. Number of rings on core + 10 (7) | $200 + 10 = 210$ | Tree age |

Accuracy Standard: $\pm 10\%$ (Based on actual tree ring count at breast height for trees ≥ 3.0 " DBH, otherwise based on total age recorded.)

Appendix O: Glossary of Terms

Glossary of Terms	
Aspect	A position facing or commanding a given direction; exposure. Aspect is the compass direction of the prevailing slope with respect to true north.
Azimuth	A horizontal angular measure from true north to an object of interest.
Basal Area	The cross-sectional area of the stem or stems of a plant or of all plants in a stand, generally expressed as square units per unit area. For trees, measured at 4.5 feet above ground, for forbs and grasses, measured at the root crown.
Bole Length	The straight-line distance measured parallel to the main bole of a tree, from its base to its tip.
Breast Height	A point located on the uphill side of the main stem, by measuring 4.5 feet along the uphill side of the bole from ground level or the predominant root collar. Preclude slight, non-compacted litter accumulations when establishing breast height.
Canopy Cover	The percent of a fixed area covered by the crown of an individual plant species or delimited by the vertical projection of its outermost perimeter; small openings in the crown are included.
Compacted Live Crown Ratio	The percent of the total height of the tree that supports a full, live crown. For trees that have uneven length crowns, ocularly transfer lower branches to fill holes in the upper portions of the crown, until a full, even crown is created.
Compartment	A land area, usually between 3,000 and 8,000 acres, easily identified on the ground by physical features. A compartment is comparable in size to a sub-watershed, or landscape management unit. It is used as a convenience for maintaining stand records and planning vegetation management projects.
Crown Class	The relative position of the tree or shrub crown with respect to the competing vegetation around it. Crown class for each tree or shrub is judged in the context of its immediate environment, that is, those trees or shrubs which are competing for sunlight with the subject tree or shrub.
Crown Length	The vertical distance from the top of the leader to the base of the crown, measured to the lowest live branch-whorl with live branches in at least 3 quadrants, and continuous with the main crown.
Crown Ratio	The ratio of compacted live crown length to bole length. Lengths are measured parallel to the bole from the base of the tree to the tip.
DEM	Digital Elevation Model. USGS geographic elevation data distributed in raster form. Digital representation of the shape of the earth's surface. Typically, digital elevation data consists of arrays of values that represent topographic elevations measured at equal intervals on the Earth's surface.
Diameter	The length of a straight-line segment passing through the center of an item and terminating at its periphery.
Diameter at Breast Height (DBH)	A measure at breast height (4.5 feet), outside bark, of the tree bole, perpendicular to the tree bole.
Diameter at Root Collar (DRC)	The straight line passing through the center of a cross section of a bole measured at the root collar of a shrub or tree.
Down Log	Stem material (conifer or hardwood) that is lying on the ground. If a stem material is leaning more than 45 degrees from vertical, is not self-supporting, and/or in contact with the ground, it is considered a down log.
Down Woody Material	Woody pieces of trees and shrubs that have been uprooted (no longer supporting growth) or severed from their root system, not self-supporting, and are lying on the ground.
Duff Layer	Duff is the fermentation and humus layer of the forest floor. It does not include the freshly cast material in the litter layer. The top of the duff is where needles, leaves, and other cast-off vegetative material have noticeably begun to decompose. Individual particles usually will be bound by fungi mycelium. When moss is present, the top of the duff is just below the green portion of the moss.

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	The bottom of the duff is the start of the soil ("A" horizon).
Elevation	Vertical distance from a datum, usually mean sea level, to a point or object on the earth's surface. Not to be confused with altitude, which refers to points above the earth's surface.
Fuel Bed	The fuel bed is the accumulation of dead, woody residue on the forest floor. It begins at the top of the duff layer and above. It includes litter, dead limbwood and bolewood from tree species, as well as dead material from shrub, herbaceous, and grass species.
Fuel Model	Mathematical descriptions of fuel properties (e.g. fuel load and fuel depth) that are used as inputs to calculations of fire danger indices and fire behavior potential.
GPS	Global Positioning System. A network of radio-emitting satellites deployed by the U.S. Department of Defense. Ground-based GPS receivers can automatically derive accurate surface coordinates for all kinds of GIS, mapping, and surveying data collection.
Ground Level	The forest floor, made up by soil and duff layer. It does not include unincorporated woody debris that may rise above the ground line. In reference to a point of measure, it is the highest point of the ground touching the base of the object being referenced.
Group Talley	A count of one or more items have the same type or species and recorded as a single line entry.
Growth	A measure of the increase in growth layers for a specified time frame.
Height Growth	The increase in height over a set period of time.
Intersect Diameter	Measurement of diameter at a point where the sampling plane intersects the geometric center of the object being tallied. No adjustment is made for stem irregularities at the point of intersection.
Lean (Tree)	The deflection from vertical, > 15 degrees of a straight line passing through the geometric center of the base and top of the main stem.
Length	The measurement of the extent of something along its greatest dimension.
Life Form	Species and individuals that are grouped into classes on the basis of their similarities in structure and function. A growth form that displays an obvious relationship to important environmental factors.
Limiting Distance	A comparative measurement between the subplot radius and the distance from the subplot center to the center of the object. The comparison is used to determine whether the object is IN or OUT of the fixed area subplot. IN - The object is "in" if the measured distance is equal to or less than the subplot radius. OUT - The object is "out" if the measured distance is greater than the subplot radius.
Live Crown Length	The straight-line distance measured parallel to the main bole of a tree, from the top of the live crown to the base of the live crown.
Ownership	The identification of the legal owner/administrator on both the surface and subsurface estates.
Plant Species	The major subdivision of a genus or subgenus of a plant being described or measured.
Plot Configuration	The size and shape of the sampling unit (plot) and the spatial arrangement of subplots within that unit.
Plot	A sub-sample of a plot or stand exam. This is the unit on which data are recorded to individual trees, snags, logs, understory vegetation, and fuels. Data can be collected on either a fixed area or variable radius area.
Proclaimed Forest	Units of the National Forest System as originally proclaimed or designated by Congress.
Quadratic Mean Diameter	The diameter of the tree of average basal area.
Radial Growth Increment	The increase in tree radius over a period of time at breast height, or occasionally at the base.
Random Sample	Any method of sample selection based on the theory of probability (degree of

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	certainty). At any stage of the operation of selection, the probability of any set of units being selected must be known. It is the only method that can provide a measure of precision of the estimate.
Reconciliation Code	A code used to reflect the status of an individually tallied item with regards to previous surveys.
Slope	A deviation from the horizontal.
Species	A code that represents a fundamental category of taxonomic classification of an organism.
Stand	A spatially continuous group of trees and associated vegetation having similar structures and growing under similar soil and climatic conditions.
Stand Exam Grid	Basic data collection method for stand exams. It consists of a set of plots, separated by equal distances on a grid pattern. The lines of the grid (transects) are oriented in cardinal directions. There is a predetermined distance between plots. The number of transects and grid plots will vary depending upon the size and shape of the stand.
Stratified Sample	A method of sampling forest resources where stands or polygons of similar properties are lumped into strata. This improves the efficiency of an inventory by reducing the variability within a given population. The less variability there is within a strata, the fewer samples will need to be taken to achieve a statistically valid result.
Stratum	A group of stands within a condition class; similar characteristics such as forest type, tree size class, and canopy density.
Stump	The woody base of a tree remaining in contact with the soil after the trunk or main stem has been severed at a point less than 4.5 feet above ground height (measured on the uphill side).
Tree	A woody perennial plant, typically large, with a single well-defined stem carrying a more or less definite crown.
Tree Age	Total age of the above ground stem of a tree (not age of the root stock or the total age from seed). Total age is usually the annual ring count to the pith of the tree at breast height plus an estimate of the number of years it took the tree to reach breast height.